Weatherwise

Career and Education Issue

Volume 6, Number 5 October 1953

FACSIMILE

FACSIMILE is the modern means of communicating weather information to both large and small meteorological offices. For over ten years American meteorological services have depended upon Times Facsimile installations for reliable operations.

TIMES FACSIMILE

CORPORATION

540 W. 58th St., New York 19, N.Y. • 1523 L St., N.W., Washington 5, D.C.

Designers & Mfrs. of Facsimile Communications Equipment for Over 15 Years

"SOME PEOPLE ARE WEATHERWISE BUT MOST ARE OTHERWISE"—BENJAMIN FRANKLIN

WEATHERWISE

THE MAGAZINE ABOUT WEATHER

DAVID M. LUDLUM, *Editor*
HENRY W. BULKLEY, *Associate Editor*
HANS H. NEUBERGER, *Technical Editor*
ERIC SLOANE, *Art Director*

Vol. 6, No. 5 October, 1953

CONTENTS

Foreword—Dean Niels C. Beck 116
Career Opportunities in the United States Weather Bureau—Francis W. Reichelderfer.. 119
A Career in the Navy Aerological Service—Capt. J. C. S. McKillip, USN 120
Air Force Weather Careers—Major General William O. Senter, USAF. 122
The Private Practice of Meteorology—David M. Ludlum 124
Meteorological Education in the United States 126
The American Meteorological Society 143
A Selected Bibliography in Meteorology 144
Meteorological Periodicals in English 147
Weatherwatch—David M. Ludlum 148

Meteorological Education in the United States

University of California 126
The University of Chicago 127
Florida State University 128
Iowa State College 129
The Johns Hopkins University 129
Massachusetts Institute of Technology .. 130
The University of New Mexico 131
New York University 132
The Ohio State University 133
Oklahoma A & M College 134
Oregon State College 134
The Pennsylvania State College 135
Rutgers University 136
Saint Louis University: Institute of Technology 136
Saint Louis University: Parks College . 137
A & M College of Texas 137
The University of Texas 138
University of Utah 139
University of Washington 140
University of Wisconsin 141

Front cover: A corner of the synoptic laboratory at The Pennsylvania State College.

WEATHERWISE is published bimonthly for the American Meteorological Society. Office of publication, 3 Joy St., Boston 8, Mass. Subscription is $3.00 per year; add 50 cents for postage to Canada and all countries in the Pan-American Postal Union; add $1.00 for all other foreign countries. Subscription orders, claims for missing numbers, changes of address, and advertising correspondence should be addressed to the society at 3 Joy St., Boston 8, Mass. Editorial offices: Franklin Institute, Philadelphia 3, Pa.

Foreword

DEAN NIELS C. BECK

Chairman, Advisory Committee on Education, American Meteorological Society

The Weatherman's Lament

Here before the dying embers
I sit and weigh my last regrets
When I'm right, no one remembers,
When I'm wrong, no one forgets.

Lest I be accused immediately of shortsightedness in thus introducing the *Career and Education* issue of WEATHERWISE, I must hasten to add the obvious: that the modern science of meteorology goes far deeper than the art of forecasting. This little piece of doggerel, however, recalls that somehow or other we finally get around to discussing this fascinating business of trying to forecast changes in weather and climate and to evaluate the effects of these changes upon men as social beings. Certainly here is science in the service of society, and here, too, the meteorologist becomes an engineer, pressing scientific fact into everyday use.

Recently when going through some old papers, I came across a dog-eared copy of the fourth edition (1938) of *An Introduction to the Study of Air Mass Analysis* by Jerome Namias. There were relatively few good English texts in those days, and the new subject of isentropic analysis was just a word to many of us, as slippery in concept as the entropy from which it had sprung.

But the Introduction presaged much of the progress in meteorological theory and education that has crowded the interim. It constituted, as it were, an early edition of the monumental *Compendium of Meteorology*, which, from the vantage point of 1951, eloquently

bespeaks the opening of unlimited frontiers in meteorology and climatology, and with this there has been a constantly expanding number of career opportunities.

There have been recessions of activity when the pessimists suggested that centralized forecasting or the post-World War II demobilization would dissipate these opportunities for years to come. Of course, nothing of the sort happened. Whole new vistas in the upper atmosphere, in tropical and polar meteorology, hydrometeorology, biological and chemical meteorology, radio meteorology, and even cosmical meteorology have been flung open for those inquiring intellects who accept the challenge.

Yes, it is true that our knowledge of so fundamental a mechanism as the general circulation of the atmosphere is still discouragingly inadequate. But we now have new techniques and new vehicles of observation. If we can agree and work together on the more promising areas of investigation, this problem, too, will be solved.

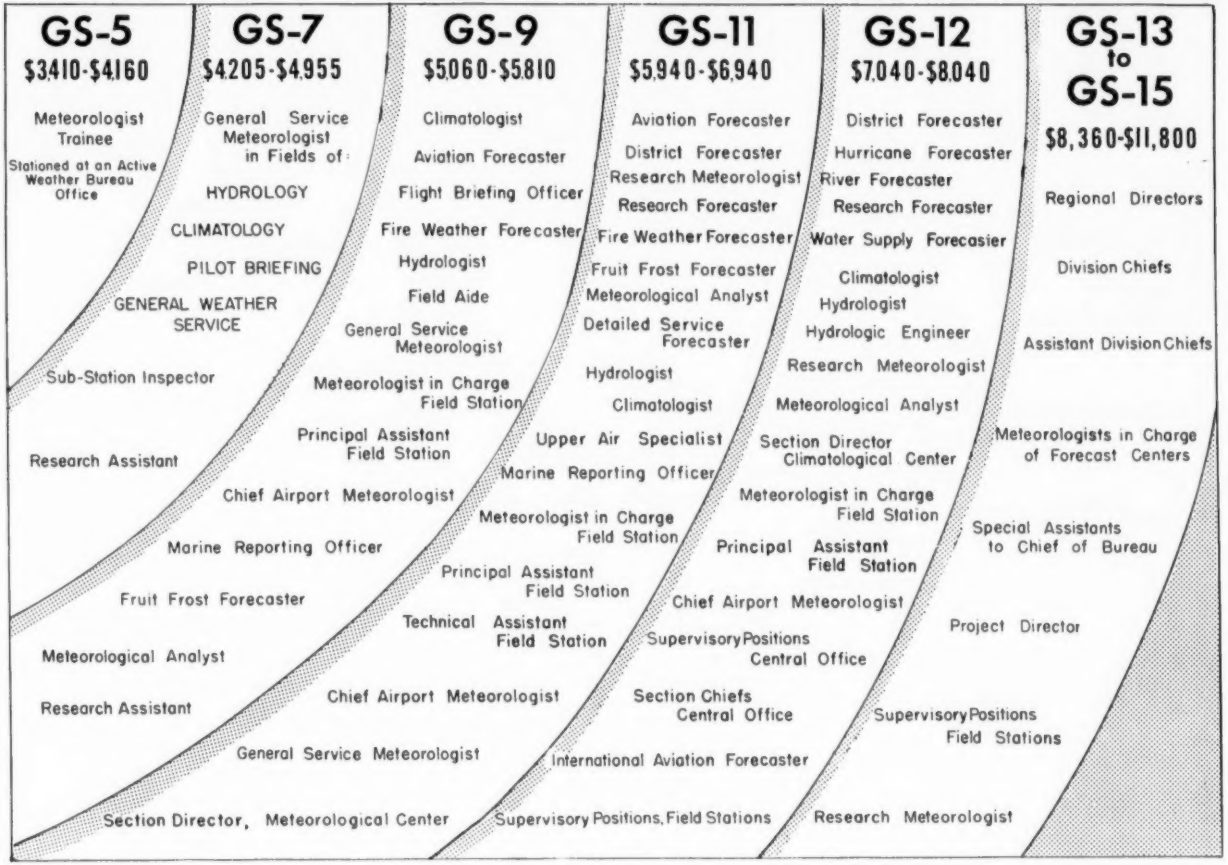
Most hopeful of all, the intervening years have seen the stockpile of scientific information increase many times. I am reminded of the many decades during which seismology was considered a pure science, finally to find many productive applications in the short space of the last 20 years.

Much remains to be done in the field of meteorological education. In the colleges and universities there should be a clear statement of purpose regarding courses in meteorology and climatology, whether this purpose is as highly specialized as preparing graduates for specific jobs in industry or as broad as providing the student with some reasonable knowledge of weather and climate as a part of his general cultural background. There is a suspicion that some courses, some faculties, and some libraries do not measure up to any part of this task. But again, as I have said, much has been accomplished. There are many excellent teachers, books, and curricula with clear-cut objectives from which the youngster who is interested in a career in meteorology can make his selection.

This issue of WEATHERWISE should be most helpful to prospective students and teachers alike. The publication which first broke ground in this field, *Weather Horizons* (1947), is now both out-of-print and out-of-date, illustrating the great changes that have taken place in our field of meteorological education in the short span since World War II. At the present time the Advisory Committee on Education of the AMS is circulating a complete questionnaire to poll American colleges and universities for additional information on their offerings in meteorology. Eventually the Committee hopes to prepare a detailed directory, up-to-date copies of which will be available at all times through the Executive Secretary's office. The questionnaire will be published in an early issue of the *Bulletin;* your comments and suggestions regarding the questionnaire are solicited by the Committee.

In closing, I should like to recall the remarks of a famous educator when speaking on the broadest aspects of education since they apply with great force to our field. In his inaugural address Abbott Lawrence Lowell, one of the many famous presidents of Harvard University, stated succinctly: "Among his other wise sayings, Aristotle remarked that man is, by nature, a social animal; and it is in order to develop his powers as a social being that American colleges exist. The object of the undergraduate department is not to produce hermits, each imprisoned in the cell of his own intellectual pursuits, but fitted to take their places in the community and live in contact with their fellow man."

THE VARIOUS PROFESSIONAL METEOROLOGICAL POSITIONS IN THE WEATHER BUREAU



Career Opportunities in the United States Weather Bureau

DR. FRANCIS W. REICHELDERFER,
Chief, U. S. Weather Bureau

THE United States Weather Bureau is one of the largest employers of meteorological personnel. The Bureau's professional meteorologists are scattered throughout the United States, Alaska, San Juan, P. R., and the Hawaiian Islands. Members of its nonprofessional ranks in meteorology are even more widely dispersed—northward to Arctic weather stations within eight degrees of the North Pole, and westward to stations on the Phoenix, Caroline, and Marianas Islands of the Pacific.

Not only does the Weather Bureau offer a wide latitude of geographical locations, it also has developed a wide range of specialized fields for the professional meteorologist. By advancement and reassignment to various specialized positions, employees may acquire a broad meteorological experience. The opportunity to gain diversified work-experience makes the Bureau jobs interesting to the employees. Furthermore, meteorologists with well-rounded experience are of greater value to the Bureau. Therefore, both the individual and the national weather service benefit by the opportunities presented by a diversified program, with considerable opportunity for transfer from place to place in the course of a career.

Candidates for meteorologist positions must have a bachelor's degree in meteorology; or four years of progressive professional experience in meteorology; or an equivalent combination of academic training and professional experience. New appointees with these qualifications are usually assigned as Meteorologist Trainees at a forecast center or active airport station. Here they acquire practical experience in weather analysis and forecasting in addition to performing observational duties and furnishing meteorological information to newspapers, radio stations, and the general public. After a year's experience, Meteorologist Trainees are eligible for promotion to General Service Meteorologist positions.

New employees who have graduate degrees in meteorology or an additional year of professional experience in addition to the qualification requirements stated in the previous paragraph, are appointed directly to positions as General Service Meteorologists, grade GS–7. The majority of the Bureau's General Service Meteorologists are employed at airport stations where they are assigned work in aviation weather service as well as in general weather service. Their briefing of pilots for commercial, military, and private aircraft involves interpretation and analysis of the reports and forecasts of ceiling, visibility, wind, and other weather conditions affecting take-offs, flight routes, and landings. In general weather service, they make adaptive forecasts for the local area using official forecasts as a guide. They supply the basic information for the preparation of forecasts by plotting and analyzing surface, winds aloft, and adiabatic charts. At most of these stations they also assist in the continuous weather watch and observational program.

While a large percentage of the General Service Meteorologists are assigned to positions that have to do with aviation and general weather service, some are assigned to work in the climatological and hydrological programs conducted by the Weather Bureau.

In climatology, they deal with quality control procedures and analytical studies of all records received, including those from about 10,000 citizen observers who report to the

(Continued on page 142)

A Career in the Navy Aerological Service

CAPT. J. C. S. MCKILLIP, USN

THE vast controlling influence of weather conditions on modern warfare has emphasized the role that the science of meteorology plays in the operations and planning of the U. S. Navy. The organization charged with the responsibility of meeting the over-all meteorological requirements entailed by the world-wide disposition of Naval forces is the Naval Aerological Service. (Aerology as used by the Navy is synonymous with meteorology. Ed.)

The Naval Aerological Service is composed of a group of highly trained personnel consisting of commissioned officers and enlisted ratings having the technical proficiency to provide the weather advisories and forecasts required by naval units ashore and afloat. To keep pace with the expanding requirements of Naval Aerology imposed by the advent of the atomic and jet eras, advanced technical education and training have been provided aerological personnel to enlarge their technical capabilities and to further their professional competence. This has led to the development of the career aerologist as the mainstay of the Naval Aerological Service.

Training for aerological duty is conducted in schools which are an integral part of the Navy's educational system. The level of training is gauged to meet the academic background and prospective duties of the trainee. Accordingly, officers receive instruction to become qualified aerological officers, and airmen undergo training to serve in the capacity of aerographer's mates.

THE AEROLOGICAL OFFICER

The U. S. Navy obtains most of its officers from two sources: the Naval Academy at Annapolis, Maryland, and the Naval Reserve Officers Training Corps Units which are established in many of the leading colleges and universities of the United States.

Upon commissioning and completion of a tour of duty with the operating forces of the Navy, the potential aerological officer applies for aerological training at the Naval Postgraduate School at Monterey, California. There he is enrolled in the Aerological Engineering course for professional instruction in theoretical and applied meteorology and oceanography. The satisfactory completion of the course, which is of 18 months duration, qualifies him as an aerological officer and leads to a three year tour in an operational billet with the Naval Aerological Service.

On completion of this three year tour, the aerological officer is eligible to apply for the Advanced Aerological Engineering course at the Postgraduate School for additional training. This course, which is also of 18 months duration, includes advanced theoretical and applied meteorology, oceanography, climatology, and higher mathematics including differential equations and vector analysis. Moreover, officers who meet the special academic requirements of the school receive a master of science degree upon graduation. Those officers who demonstrate outstanding ability are offered the opportunity to receive additional training in meteorology at selected civilian institutions leading to a doctorate degree.

Having acquired a substantial background in meteorology, the aerological officer may apply for the designation Aeronautical Engineering Duty (Aerology), which classifies him as an aerology specialist and a career mem-

ber of the Naval Aerological Service. As a specialist the aerological officer is assigned to key operational and administrative positions. He also participates in applied research, operational weather analysis, and research and development of new meteorological methods.

The courses in aerological engineering taught at the Postgraduate School are now offered to qualified officers of the Naval Reserve on active duty. Since the Navy's integration program permits Reserve officers on active duty to apply for regular commissions, a Reserve officer may qualify also for the career status available to all Regular officers.

The Aerographer's Mate

Personnel wishing to become aerographer's mates must be high school graduates or have satisfactorily passed the U. S. Armed Forces Institute high school test. All enlisted personnel upon entering the Navy are sent to a Recruit Training Center for eleven weeks of indoctrination, basic training guidance, and classification. Following this period selected candidates attend the Airmen School at Norman, Oklahoma, for an eight-week course.

Individual aptitudes, academic background, achievement in previous training, and personal desires determine the applicants who will be chosen to attend the Primary Aerographer's Mates School at Lakehurst, New Jersey.

The primary school provides sixteen weeks of instruction in operation and maintenance of meteorological instruments, weather codes, adiabatic charts, upper-air soundings, pilot balloon soundings, weather and cloud observations, and practical work in the preparation of meteorological charts.

Advanced training is available to petty officers of this rating to augment their technical knowledge and to further their proficiency. In addition to the primary school there are two advanced schools identified as the "B" and "C" schools for aerographer's mates.

The "B" school is of twenty weeks duration and covers meteorological theory, map analysis, and forecasting. Completion of the "B" school is a prerequisite for advancement to the rate of chief aerographer's mate. The "C" school provides a five-week period of training in the operation and theory of current types of meteorological electronic equipment.

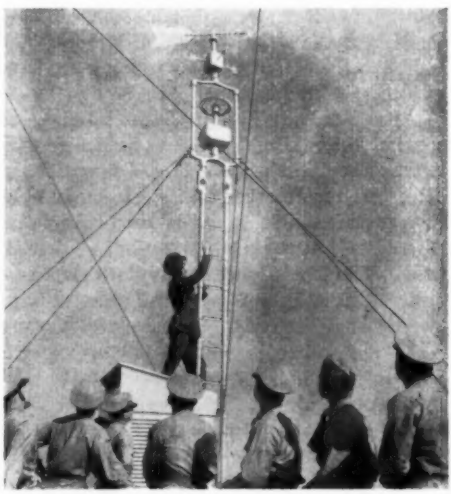
Advancement to the rate of chief aerographer's mate may be achieved by enlisted personnel in the aerological service. Petty officers, moreover, possessing extraordinary qualities of leadership and rendering outstanding performance of their duties, have the opportunity to attain warrant officer and limited duty officer commissioned status.

The path of advancement in the career of the aerographer's mate proceeds within the rating structure of the Navy as follows:

Seaman recruit or Airman recruit
Airman apprentice
Airman
Aerographer's mate, third class
Aerographer's mate, second class
Aerographer's mate, first class
Warrant
Commissioned warrant
Commissioned officer (LDO)

The Naval Aerological Service is an inherent part of the organization of the Navy and accordingly provides the individual a stimulating and rewarding Naval career. As a professional service manned by personnel with the highest technical ability and experience, it supplies the technological opportunities for a successful career in the challenging science of meteorology.

For details and additional information write to the Bureau of Naval Personnel, Department of the Navy, Washington 25, D. C.



Air Force Weather Careers

MAJOR GENERAL
WILLIAM O. SENTER, USAF

THE Air Weather Service of the U. S. Air Force, like any other military organization, presents attractive career opportunities at two levels—commissioned and enlisted. Challenging, worth-while careers in weather are available to men and women in either status.

Recognizing the advantages of attracting and retaining qualified personnel, the Air Weather Service designed its airman career program to allow ambitious young airmen to advance in accordance with their capabilities.

The Air Force has established many technical courses to train various types of weather specialists, and instructors and training facilities are the finest available. Most weather courses for airmen are conducted at Chanute Air Force Base near Champaign, Illinois. In combination with instation training and field experience, this formal training produces skilled weather personnel.

After graduating from basic training, an airman entering the weather career field may attend the Weather Observer Course to prepare him for observer duties. Upon completion of this course, he will most likely be assigned to a base weather station. There he will perform a multitude of duties such as observing and recording weather conditions, coding and decoding weather data, plotting weather data, and operating teletypes.

After seasoning as an observer, the weather airman is ready for the Meteorological Technician Course. There he gains the necessary know-how to analyze a mass of plotted data, to prepare detailed weather information for forecasts and briefings, and to make use of upper-air data, in addition to learning the mathematics and physics needed for an understanding of the behavior of the atmosphere.

Following graduation, the new "met tech" will apply his know-how to operational situations. He will analyze both surface and upper-air charts. He will serve as an apprentice forecaster by preparing, under supervision, weather briefings and cross-sections and will supervise weather observers, key jobs in the big weather stations and centrals.

Later the met tech may attend the Weather Forecasting Superintendent Course to qualify himself as a full-fledged forecaster to perform the duties of a forecaster.

A few graduates of the Meteorological Technician Course may enter the Climatological Technician Course where the student learns to collect and catalog weather data and to analyze past data, the procedures necessary to utilize historical weather data. After graduation he will be assigned to climatological duties in the field.

We humans, living at the bottom of a vast ocean of air, are inclined to think only in terms of phenomena occurring at the earth's surface. But the operational ceiling of today's jet aircraft is above 30,000 feet and is steadily rising. To provide efficient weather service for these high-flying jets, complex electronic equipment is used to probe the atmosphere to heights of 100,000 feet.

Skilled operators and technicians are needed to use and maintain this equipment. Airmen

entering the equipment division of the weather career field are enrolled in the Ground Weather Equipment Operator Course. Each airman is taught to operate the rawinsonde set, consisting of a balloon-borne transmitter and a ground receiving and recording device. From the data gathered by rawinsonde runs, winds, temperature, humidity, and pressure values can be determined for various levels. Students graduating from this course are assigned as operators on rawinsonde crews.

A seasoned equipment operator may later attend the Weather Equipment Technician Course, where he is taught to maintain complex weather equipment such as radar storm-detection sets, rawinsonde sets, and ceilometers. Upon completion of this course, the airman is a weather equipment technician, qualified on all major types of weather equipment. After a period of apprenticeship, he becomes well qualified to supervise both maintenance and operation of a rawinsonde section. Further training is available, following experience in the field, through the Weather Equipment Superintendent Course.

At the commissioned level, weather officers are trained in meteorological departments of outstanding universities throughout the United States. For entry into this program, applicants must hold a bachelor's degree with credit for mathematics through integral calculus and a year of college physics.

Depending upon the university attended, courses include synoptic and dynamic meteorology, as well as climatology, observations, and meteorological instruments. Possible electives include physical meteorology, thermodynamics, oceanography, physics, advanced mathematics, electronics, statistics, and possibly a foreign language, in addition to micrometeorology and other special topics.

New graduates are assigned to forecasting duties at one of the 238 weather stations in the world-wide AWS network. These stations are primary outlets for weather information, where the forecaster first comes face to face with the people who make operational use of weather advice. Through this basic experience, weather officers are qualified for duties of greater responsibility in weather centrals. The experience also readies them for positions requiring the ability to direct the operation of weather stations and for later specialization in micrometeorology or climatology.

After several years of experience in the field, many weather officers are assigned to command a weather station. This duty carries grade requirements varying from first lieutenant to lieutenant colonel. In a small station, administrative duties are limited and commanders also perform routine forecasting duties and serve as staff weather officers. Larger stations require the commanders to devote most of their time to supervision of the unit's technical work and to administrative and staff weather duties.

There are a variety of activities in which the Air Weather Service engages, over and above the observing, forecasting, and briefing services provided at each Air Force base. Regular and special aerial weather reconnaissance is conducted over the Arctic, the Atlantic and Pacific Oceans, and over land areas where ground stations cannot feasibly be located. Meteorological assistance of a specialized nature is supplied to military agencies engaged in rocket and guided missile operations, chemical warfare, and nuclear physics projects. Climatological studies are prepared in support of research and development, military planning, and daily operations.

For further information address the Commander, Air Weather Service, Andrews Air Force Base, Washington 25, D. C.

The Private Practice of Meteorology

DAVID M. LUDLUM, *Chairman, Committee on Industrial, Business, and Agricultural Meteorology, American Meteorological Society*

OPPORTUNITIES for a career in meteorology by an individual outside of the government and military services are unlimited. The great expansion of our scientific horizons in recent years and the ever-increasing demands of our national economy have called on the services of meteorologists in fields undreamed of fifteen years ago. The ramifications of meteorology now extend to almost all human activities, though the implications of our relatively new science are largely unexplored.

Nevertheless, the growth of the private practice of meteorology has hardly kept pace with the demands of the public or measured up to the hopes of those within the profession. The reasons for this are not hard to find. The academic training demands are high, the interneship is long, and the compensation, considering the time and talent expended, is on a generally unsatisfactory level, especially when compared to other technical and engineering professions. The all-pervading fact in meteorology is that there has been a virtual government monopoly in this field for many years, and the private meteorologist must meet the competition not only of his fellow scientists, but also of a large and vigorous tax-supported government agency.

Despite the drawbacks of pioneering a new profession, there are hundreds of persons pursuing meteorology as a private career, many more than may appear to an outside observer. The profession of private meteorologists includes not only those who are self-employed or who make up the professional personnel of a forecasting or weather control company, the industrial meteorologists, but also takes in those who are engaged in research in meteorology, whether they be employed by corporations, universities, or projects financed by government funds. In this sense the private practice of meteorology is a going business, and there are many more demands for specialized meteorological skills than there are qualified persons to fill them.

Where does the private meteorologist work, and how does he earn a living? The answer to this is as varied as are the abilities and inclinations of the individual concerned. In the first place, he may be self-employed and pursue a professional career individually, just as any other engineering or industrial consultant. One should be reasonably well established in the profession to do this and should be extremely self-reliant and resourceful. He may starve or grow fat according to how he can combine professional skill with salesmanship. Secondly, weathermen may be associated as a group in a company organized for the specific purpose of making forecasts, conducting weather control activities, and carrying out research, for one or more clients. There are several such companies active today in various parts of the country.

A third employment category finds the meteorologist as a permanent employee of a business or industrial corporation where his duties are devoted to weather science either part-time or full-time according to current needs. The public utilities and heavy chemical manufacturing industries have several examples of this. A fourth framework places the meteorologist as a member of a group employed by a corporation with specialized, full-time meteorological duties, such as the member of an airline forecasting section. This probably comprises the largest single group of private meteorologists. A fifth form of occupation takes in those whose main duties revolve around educational administration and teaching, but who have time and talents to devote to consulting with private industry and government research projects, either as an individual or as a member of a university department.

What does the private meteorologist do? In the minds of the general public, his chief product is largely concerned with short-range forecasting. Here, of course, the competition of the free forecasting services of the Weather Bureau has made sales to budget-minded businessmen rather difficult, but the private forecaster has been able in many instances to sell

his wares because, after a study of his client's industry, he can tailor his forecast to the specific needs of the particular business and can give preferential, detailed, and up-to-the-minute weather advice when required. Like a physician, the consulting meteorologist watches over his client's weather situation and gives both long- and short-range advice.

A second main field of activity lies in the preparation of a background survey to determine in detail what are the weather effects on the client's activity. After a proper climatological study it can be determined whether a forecast would be of value and whether it should be based on long-range probabilities or on current synoptic indications. The subject of applied climatology has long been neglected in this country, but at the present time there seems to be a renaissance of interest in a field that should offer an interesting and lucrative career for the qualified consultant.

A third sphere of activity at present is weather control. Cloud seeding activities are the source of major economic and political controversies in many parts of the country, and recent federal recognition of the problem was signaled by an act of Congress setting up a regulatory commission to supervise all individuals engaged in cloud seeding activities. The rewards from this phase of applied meteorology are reported to be high since the recent development of cloud seeding techniques have coincided with both a greatly increased demand for water and damaging droughts in many parts of the country. The corollary field of hydrology, too, offers scope for the meteorologically-trained consultant and an exchange of personnel between the two has been constant.

In another area of activity, the field of public information, the private meteorologist can engage profitably as a part-time job to supplement his income and to give personal publicity to his other meteorological activities. Radio and television, of course, offer excellent media for this. In some of our large centers of population the public demand for personable, up-to-the-minute presentation of weather information is so great that full-time weathermen are retained.

A fifth major occupational field comprises the combination of teaching and research. It is an unimaginative meteorology professor who walks a campus today without two or three consulting contracts in his pocket. To many professional meteorologists this offers the ideal combination—the dignity of a university connection, the privilege of instructing the young, and the opportunity of pursuing unfettered research along congenial lines.

Despite the opportunities offered by the private practice of meteorology today, one should not enter into this career without full consideration of the difficulties ahead. One must complete the college requirements in mathematics and physics in addition to the meteorological courses, one should pursue his graduate studies through the Ph.D., and an interneship of several years should then be served with an established weather service. Then, if the proper financial foundation is achieved, one may feel qualified to enter into one of the fields of activity outlined above.

Dr. Wallace Howell, an industrial meteorologist, discusses water supply problems with officials of New York City.

Meteorological Education in the United States

Facilities at Twenty Leading Universities

University of California

AT the University of California studies of the atmosphere are conducted principally by the Department of Meteorology and the Institute of Geophysics on the Los Angeles campus. However, particular aspects are also studied in various other departments. Thus the Scripps Institution of Oceanography at La Jolla conducts studies on the interaction between the ocean and the atmosphere, the Department of Agricultural Engineering at Davis investigates atmospheric processes with particular respect to protection of plants and domestic animals from heat and frost, the Departments of Engineering at Los Angeles and Berkeley have had projects concerned with atmospheric radiation, turbulence, pollution, fog, and icing, and the Departments of Geography at Berkeley and Los Angeles are concerned with climatology and climatic influences on human acivities.

The curriculum in meteorology was established under the Physics Department at UCLA in 1940, when Professor Jakob Bjerknes, the eminent Norwegian meteorologist and discoverer of the polar front theory of cyclone formation, was appointed to the staff. It was established as a separate department in 1944, and has undergone continuous growth so that it now has seven regular positions on its teaching staff, in addition to a large group of research associates working on projects. Besides Professor Bjerknes, the professional staff includes J. Holmboe in dynamic meteorology, M. Neiburger in synoptic and physical meteorology, Z. Sekera in dynamic and physical meteorology, Y. Mintz in synoptic meteorology and climatology, and J. G. Edinger in synoptic and experimental meteorology. A vacant staff post will be filled shortly, and another position will probably be established within a year. The department also draws on Professor J. Kaplan, specialist of the physics of the higher atmosphere, of the Physics Department, and Professor C. E. Palmer, authority on tropical meteorology, and Professor R. E. Holzer, atmospheric electricity, both of the Institute of Geophysics, for courses and supervision of research in these specialties.

The facilities of the Department of Meteorology include complete synoptic laboratories, with Service A, C, and O teletype receivers, Facsimile weather map receiving equipment, an Ozalid printer for duplicating weather maps, a complete observatory with instruments for measuring all meteorological variables including radiation, upper-air temperature and wind, and humidity, and laboratories for instruction and research in instruments and physical meteorology, including cloud physics. A new building is being planned for the department, in which all these facilities will be expanded and a hydrodynamics laboratory added.

The Department of Meteorology offers curricula leading to the degrees of Bachelor of Arts, Master of Arts, and Doctor of Philosophy. The bachelor's curriculum gives a broad basic training designed as a foundation for employment in any phase of meteorology, but particularly as forecaster in the Weather Bureau, the airlines, or the military. The

Training weather forecasters at the University of Washington.

curriculum for the Master's degree is designed to further this basic training, but allows some specialization, usually in synoptic or dynamic meteorology. The requirements for the Ph.D., in addition to a broad foundation, include specialization in some branch of meteorology sufficient for the candidate to make an original research contribution. Doctoral research in the past few years has included work in dynamics of wave motion, synoptic studies of the atmospheric circulation, atmospheric radiation, ionospheric processes, diffusion, and cloud physics.

Degrees with a specialization in atmospheric physics are also offered by the Department of Physics at UCLA, under supervision of members of the Institute of Geophysics. Those who wish to emphasize physics in their preparation and have no interest in problems related to weather forecasting or atmospheric flow may prefer to enroll in these curricula.

Besides its normal teaching and research activities, the department engages in research under sponsorship of governmental agencies. Currently these projects include studies of the general circulation of the atmosphere, the structure of the subtropical anticyclone, the polarization of sky light by atmospheric scattering, meteorology of the Arctic, utilization of transosonde trajectories for synoptic analysis, and the dynamics of atmospheric flow. Projects under the Institute of Geophysics include studies of the worldwide variation in the flow of electrical current from the high atmosphere to the surface of the earth, and the structure of atmospheric flow-patterns and weather phenomena in tropical regions. At present the tropical meteorology project is located in Hawaii.

The sponsored projects offer opportunities for part-time employment for undergraduate and graduate students, and full-time employment for Ph.D. candidates whose thesis problem is related to the subject of the project. Graduate students may also obtain employment as teaching assistants. Undergraduate scholarships and graduate fellowships are available; these are not limited to meteorology students, and competition for them is keen.

Information concerning requirements for admission, courses offered, and requirements for degrees, will be found in the General Catalogue of the University and the Announcements of the Graduate Division. The General Catalogue is for sale for twenty-five cents by the UCLA Students' Store, Los Angeles 24, California, and the Announcement of the Graduate Division, is available on request to the Dean of the Graduate Division, UCLA, Los Angeles 24, California. Questions unanswered by these publications may be addressed to the Chairman, Department of Meteorology, UCLA.

The University of Chicago

THE Department of Meteorology at the University of Chicago was established in the autumn of 1940. Prof. Carl G. Rossby was chairman of the department until 1948, and was succeeded by the present chairman, Prof. Horace R. Byers. The permanent objectives of the department are to provide comprehensive training in the meteorological sciences and to engage in basic researches on fundamental problems of the atmosphere. There are now seven faculty members active in the teaching program, and a professional staff of more than 30 engaged in research.

In its primary educational functions the department assists qualified students in obtaining knowledge of the basic fields of meteorology and provides opportunities for advanced research. Students who plan to major in meteorology should obtain a good background in college mathematics and physics along with their general college education. The curriculum of the department includes elementary, intermediate, and advanced courses dealing with the basic fields of meteorology. The University awards the M.S. and Ph.D. as professional degrees in meteorology, and the B.S. as a qualifying degree for advanced study or as a terminal degree in general education. Inquiries concerning the educational program of the department may be addressed to the Department Counselor, Department of Meteorology, The University of Chicago, Chicago 37, Illinois.

The research activities of the department are centered around the special interests of members of the faculty. Advanced courses reflect the work of these research projects. At the present time the principal research efforts are devoted to the following: a program of cloud physics research under the di-

rection of Prof. Horace R. Byers, based upon laboratory studies, radar, and airplane flight investigations; a program of hydrodynamical models research under the direction of Prof. Dave Fultz on quantitative laboratory-scale investigations of convective and mechanical fluid flows corresponding to the medium and large-scale motions of atmosphere; a Weather Forecasting Research Center under the supervision of Prof. Sverre Petterssen, which operates with the Weather Bureau Forecast Center in developing and testing new techniques in weather forecasting; a program of research in tropical meteorology under the supervision of Prof. Herbert Riehl, concerned with the general circulation in low latitudes, tropical disturbances, and the interaction of the atmosphere between tropical and middle latitudes.

The Chicago District Forecast Center of the U. S. Weather Bureau is located on The University of Chicago campus in one of the buildings occupied by the Department of Meteorology. The direct contact thus established between the department and personnel and facilities of the District Forecast Center presents excellent opportunities for studies aimed toward improvements in forecasting theory and practice.

The Florida State University

ESTABLISHED in 1949, the Department of Meteorology at Florida State University, Tallahassee, has rapidly taken its place among the leaders in meteorological education in the United States. The department prides itself on its faculty, facilities, and spirit—the three most important elements for sound university education.

The permanent faculty consists of Dr. Werner A. Baum, professor and head of the Department of Meteorology and editor of the *Journal of Meteorology;* Dr. Seymour L. Hess, professor; Dr. Thomas A. Gleeson, associate professor; Dr. Leon Sherman, associate professor; Dr. Noel E. La Seur, assistant professor; and Mr. Holbrook Landers, instructor. Dr. Franklyn C. W. Olson, research associate in the FSU Oceanographic Institute, teaches courses in physical oceanography in the Department of Meteorology. Advanced graduate students serve as teaching assistants in the synoptic laboratory.

The University maintains an excellent meteorological library and a spacious, well-lighted synoptic laboratory. Offices and research rooms are in a converted residence, which provides ample space and lends itself to informality.

The department believes that close contact between student and faculty, outside the classroom, is an essential part of graduate education. Much may be learned in a "bull session" over a cup of coffee. The faculty exists for the students; the students are at FSU because of the faculty; on this basis, the entire department operates as a team.

The department offers the B.S., M.S., and Ph.D. degrees in meteorology. The primary capabilities and interests of the faculty lie in the areas of tropical meteorology, climatology, theoretical meteorology, and synoptic meteorology. The education of climatologists, incidentally, is predicated on the belief that it is difficult to distinguish between meteorology and climatology, and that a climatologist must be well versed in the basic fields of synoptic and theoretical meteorology.

The department is approved by the USAF Institute of Technology for training of Air Weather Service officers in basic meteorology, advanced meteorology (general), and advanced meteorology (climatology). In cooperation with the Office of Naval Research and the Geophysics Research Directorate, Air Force Cambridge Research Center, the department is engaged in several research projects that coincide with the faculty's interest in advancing the frontiers of meteorological knowledge. These provide students with an excellent opportunity to gain experience in research problems.

Graduate assistantships are available from time to time. Veterans will be interested in the fact that an individual of legal age may acquire Florida citizenship by affidavit, no previous residence being required. The department has available a brochure which describes degree requirements in detail. Inquiries are welcome and should be addressed to Dr. Werner A. Baum, Department of Meteorology, Florida State University, Tallahassee, Florida.

Iowa State College

IN 1946, Iowa State College introduced into the curricula of two of its departments a number of courses designed to provide both graduate and undergraduate training in the fields of meteorology and agricultural climatology. Within the Department of Physics fundamental study in meteorology and climatology may be pursued; while within the Department of Agronomy more specialized courses in agro-climatology are offered. Drs. Shaw, Barger, and McDonald are permanent members of the teaching staff in these two departments, and two other members of the staff of the Department of Physics, Dr. Kassander and Mr. Stewart, are full-time research investigators currently working in the field of micrometeorological instrumentation and analysis. This micrometeorological investigation is sponsored by the Geophysical Research Directorate of the Air Force Cambridge Research Center.

Courses offered in the Department of Physics include general climatology, descriptive meteorology, physical meteorology (two quarters), dynamic meteorology, micrometeorology, and advanced dynamic meteorology. The Department of Agronomy offers courses in agricultural meteorology, plant climate, and methods in climatology.

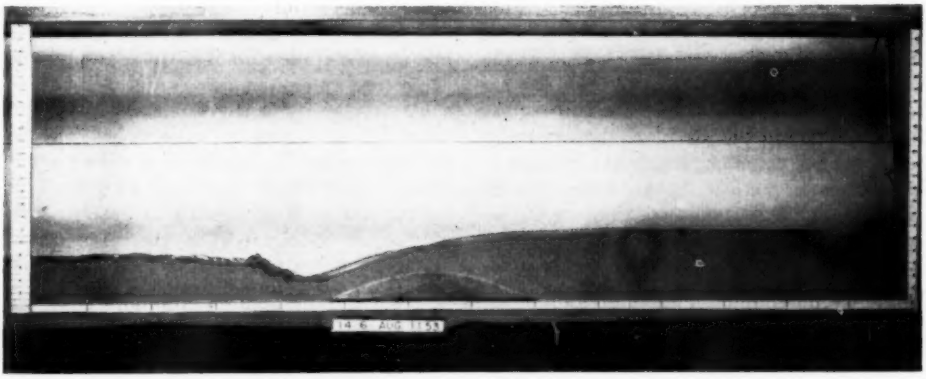
Research activities currently in progress within the Department of Physics fall into two categories: theoretical cloud physical studies and automatic analysis techniques. In conjunction with the latter, a high-speed electromechanical tabulator has recently been developed for use in statistical analysis of continuously recorded data such as those obtained in many micrometeorological studies. Its first application is now being made to the treatment of magnetic-tape recorded data on turbulent temperature fluctuations.

Investigations of a wide range of problems in the field of agricultural climatology are carried out by students and staff in the Department of Agronomy, many of these being primarily concerned with micrometeorological phenomena. Effects of leaf temperature and in-crop humidity on the growth and spread of certain crop diseases have been studied closely, dew formation processes are now being examined in several of the College's experimental farm sites, and statistical methods for predicting various crop-maturation phenomena and statistical studies of the function of weather factors in crop yields are under continuous development.

There are normally opportunities for appointment of qualified students to graduate assistantships in both the Departments of Physics and of Agronomy. Inquiries concerning such appointments should be addressed to the chairman of the one of these departments most closely associated with the applicant's research interests. Address your inquiries to the proper department, Iowa State College, Ames, Iowa.

The Johns Hopkins University

THE Johns Hopkins University offers a program in meteorology that is unique in organization and philosophy. Problems of atmospheric structure and dynamics are



A model at The Johns Hopkins University illustrates the effect of a mountain barrier on air flow.

treated as particular applications of the principles of fluid mechanics and thermodynamics. Accordingly, the student is required to develop a proficiency in these broader areas as a prerequisite to specialization. Theory is emphasized in meteorological training; descriptive and synoptic meteorology are introduced only as a means of presenting the problems to be solved and of illustrating the applicability and limitations of theoretical techniques of analysis.

Only one undergraduate course is offered in meteorology, and no bachelor's degree is available in that field. Students, however, may enter The Johns Hopkins University after graduation from high school and may pursue a curriculum in science or engineering which will lead to specialization in meteorology. Under the Hopkins Plan, barriers between undergraduate and graduate programs have largely been eliminated and students are encouraged to undertake advanced courses and to participate in research under staff supervision as soon as their training and ability warrant.

Students from other universities who have completed a four year degree in meteorology or an allied field such as physics may also be accepted for advanced study. At first, the advance student is expected to concentrate his efforts in fluid mechanics, mathematics, and certain areas of physics; formal courses in meteorology generally occupy not more than one-fourth of his program. In later years the student is encouraged to develop his understanding of atmospheric processes through a semi-tutorial system of instruction based on reading courses and seminars. Such a program is possible because of the limited number of advanced students accepted.

The program in meteorology is part of the Fluid Mechanics Division of the Department of Civil Engineering. There are two regular staff members in this division who are meteorologists by training: Professors George S. Benton and Robert R. Long. Other professional meteorologists hold positions on the research staff.

Present research studies include analyses of the energy and momentum budget of large-scale atmospheric circulations, of fundamental problems in the mechanics of rotating fluids, and of the physics of stratified fluid systems. A well-equipped hydrodynamics laboratory is maintained for model and other experimental research. Current research is sponsored in part by the U. S. Air Force, Navy, and Weather Bureau, and a limited number of part-time and full-time research assistantships are available to qualified students. For further information regarding the curriculum or research opportunities, write to Dr. George S. Benton, Department of Civil Engineering, The Johns Hopkins University, Baltimore 18, Maryland.

Massachusetts Institute of Technology

METEOROLOGY, as a professional course, was established at M.I.T. in the fall of 1928 and thus celebrates its silver anniversary this year. Aside from the extraordinary years of World War II the Department of Meteorology has experienced steady growth since its beginnings as a division of the Department of Aeronautical Engineering. There are now eight faculty members: Professors Willett, Austin, Starr, Keily, Malone, Wurtele, Bemis, and Houghton plus some 20 junior staff and research scientists. The department occupies two floors of a large fireproof building that contains complete facilities for instruction and research.

The department offers a four year undergraduate program in meteorology leading to the Bachelor of Science degree. A broad selection of graduate courses is offered in preparation for the advanced degrees of Master of Science, Meteorologist, and Doctor of Science. The undergraduate program provides sound training in mathematics and the physical sciences and instruction in all of the major areas of meteorology. In addition there is included an elective program of about seven subjects that is, in effect, an undergraduate "minor." The elective subjects are selected by the student, in cooperation with his advisor, to provide an integrated program in a related field. It is possible to arrange such a program in any one of the 20 areas of science, engineering, architecture, industrial management, and humanities available at M.I.T. This elective program is particularly valuable for students who plan to enter industrial meteorology or some phase of meteorology closely allied to another field. Grad-

uate instruction is available in practically all of the branches of meteorology including dynamic meteorology, synoptic meteorology, extended forecasting, physical meteorology, radar meteorology, climatology, numerical forecasting, turbulence, and instrumentation. As an important adjunct to the more formal academic work, graduate students are encouraged to take part in the research and teaching programs of the department. This also provides important financial assistance to the students. Contact with the other meteorological organizations in the area, such as the Air Force's Geophysical Research Directorate, the Blue Hill Meteorological Observatory, and the Woods Hole Oceanographic Institution, provides valuable additional experience.

The department maintains a large and varied program of research designed to advance the frontiers of knowledge and to strengthen the program of instruction. At the present time the major research projects are on radar meteorology, climatology, turbulence, extended forecasting, the general circulation of the atmosphere, cloud particle instrumentation, and short-range forecasting. Students have opportunities to participate in all of these programs and often find a suitable thesis topic in one of them. Ample facilities are available for individual research on other topics.

Graduation from an accredited high school or a satisfactory grade on standard college entrance examinations is the basis for admission to the first year of the undergraduate program. Students in good standing in other colleges or universities may enter the program at the appropriate level on the basis of their college record. General information on admission may be obtained from the Director of Admissions and more specific information from Prof. D. P. Keily of the department. The basis for admission to the Graduate School is a baccalaureate degree in science or engineering from a recognized college or university. Students with no previous training in meteorology will usually require two academic years to qualify for the Master of Science degree. Financial aid of many kinds is available to all students. Further information may be obtained from the Director of Admissions or from Prof. J. M. Austin, Department of Meteorology, M.I.T., Cambridge 39, Mass.

The University of New Mexico

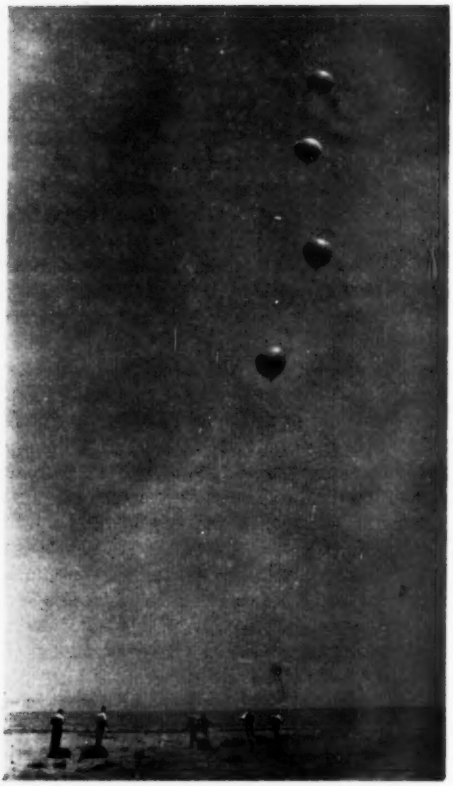
THE Department of Physics at The University of New Mexico offers a program of study in meteorology leading to a Bachelor of Science degree in this field. Courses on the junior-senior level required for the degree include six semester hours of synoptic meteorology, six hours of dynamic meteorology, three hours of meteorological instruments and observations, eight hours of synoptic meteorology laboratory, three hours of climatology, three hours of atmospheric physics, and at least five additional hours of upper divisional work in mathematics or physics. The prerequisites for all of the aforementioned courses are differential and integral calculus and general college physics. The general requirements of the College of Arts and Sciences include nine semester hours of English, nine hours of social sciences, and twelve hours of a foreign language.

The department has its own complete weather station. Part of the work in the synoptic meteorology laboratory course consists of working in the weather station, where current weather forecasts are made under typical conditions. For instruction in synoptic meteorology laboratory, the department has its own photographic and printing equipment for rapid reproduction of current weather charts, as well as selected past series and other charts of various kinds.

In atmospheric physics the department has been studying the concentration of atmospheric ozone as a function of time near the earth's surface and the vertical distribution of atmospheric ozone up to 100,000 feet with instruments carried aloft by sounding balloons. These ozone studies involve microchemical methods as well as ultra-violet spectroscopy. The department has received generous support toward its experimental research program from governmental and private agencies.

Qualified graduate students may choose atmospheric physics as their field of specialization in working toward an M.S. or Ph.D. degree in physics.

The department is under the chairmanship of Victor H. Regener, professor of physics.



Sounding balloons are employed at The University of New Mexico to measure ozone in the stratosphere.

Among the staff members with duties in meteorological instruction are: John G. Breiland, assistant professor, and Francis N. Buck, lecturer. Research in atmospheric physics and cosmic radiation is being carried on with the cooperation of Roy Thomas, professor, Robert R. Brown and John R. Green, assistant professors, Darol K. Froman, consulting professor, and Gerald Bowen, research associate.

Inquiries should be directed to Prof. Victor H. Regener, Department of Physics, The University of New Mexico, Albuquerque, New Mexico.

New York University

THE Department of Meteorology and Oceanography was established as the Department of Meteorology in 1938. Its name was officially changed to include Oceanography in 1952, although research and some graduate courses in this subject had been conducted before that time.

The academic staff of the department consists of eight full-time members of professorial rank. The undergraduate curriculum leads to the B.Sc. degree. On the graduate level the M.Sc. and Ph.D. degrees are given. Depending on the elected major subject, meteorology or oceanography, students may take courses primarily in one or the other field and select a thesis topic from either science.

The facilities of the department include a weather station with teletypes and facsimile machines for receiving synoptic data and weather maps and a laboratory for studies in atmospheric physics and instrumentation. Opportunity for field work in oceanography is offered in cooperation with the Woods Hole Oceanographic Institution at Woods Hole, Massachusetts. Graduate students enrolled in the Department of Meteorology and Oceanography at N.Y.U. may register and receive credit by the University for work done in the laboratories and ships of this institution during the summer.

The department is at present conducting research work mainly in the following subjects: Meteorology—atmospheric oscillations, small-scale turbulence, cyclogenesis, atmospheric energy balance, theory of tropical cyclones, dynamics of large-scale flow patterns of the westerlies; Oceanography—ocean wave forecasting, analysis and interpretation of ocean wave records and observations, and sea-atmosphere interactions.

The investigation of ocean waves is now being extended to include the study of ship motions. This investigation, which is being conducted in close cooperation with the Woods Hole Oceanographic Institution, makes use of stereophotographic pictures of a ship's motion and wave patterns. The results of this and other research work are published in scientific journals and in a series of monographs entitled "Meteorological Papers," issued by the department.

Much of the research work is under the sponsorship of government agencies. It is conducted under the direction of the professorial and research staff members of the department with the participation of many of the graduate students working towards a Master's or Doctor's degree.

The department is also offering annually research fellowships of varying amounts for qualified graduate students. Inquiries about these fellowships, about positions as research assistants and associates on research projects, and about details concerning admission as undergraduate and graduate students and curricula in meteorology and oceanography should be addressed to: Department of Meteorology and Oceanography, College of Engineering, New York University, Bronx 53, New York.

The Ohio State University

OHIO and The Ohio State University have been prominent throughout the development of meteorology in the United States. Dr. T. C. Mendenhall, Professor of Physics, was a leader in the establishment of "a meteorological bureau for the State of Ohio" created by Act of the General Assembly in 1882, and he served as president of the board of directors of this group for several years. The University has maintained a climatological station continuously since 1882, nine years before the establishment of the United States Weather Bureau.

There have been alternate periods of activity and relative dormancy in the academic meteorological program. Since the initiation of the present program in 1947, with the retention of a professional meteorologist of faculty rank, a continuous growth has been evident. The formal course offerings in meteorology are listed in the 1953–54 catalog. These courses are adequately complemented by appropriate work in chemistry, mathematics, physics, the humanities, and electives in other fields to provide a sound B.S. degree with meteorology major. Because the meteorological course work is offered in the Department of Physics, the degrees also are awarded in physics.

Graduate work leading to the M.S. and Ph.D. degrees may be carried forward in a number of research fields. Prominent among the research activities pertinent to meteorology within the department are: the physics of artificial and natural precipitation, spectroscopic investigation of the constituents of the atmosphere, study of the large scale distribution of carbon dioxide in the atmosphere, atmospheric turbulence in relation to astronomical seeing, and the synoptic study of observed climatic changes. In addition, a very broad choice of research topics in applied meteorology is available, such as the role of weather phenomena in bird migrations (cooperating with zoology), meteorological considerations in respect to atmospheric allergens (cooperating with botany, medicine), atmospheric pollution and its control (cooperating with various departments of the University, civic authorities, and industrial firms), and the functional relationship of micro- and macrometeorological variables to crop production (cooperating with agronomy, horticulture, botany).

Since 1951 when the New Physics Building was completed, the meteorological office has occupied an excellent suite of rooms on the top floor. These include an office, a file room, a plotting-teletype room, a spacious classroom-laboratory, and a penthouse laboratory. Additional space shared with other branches of the physics department are the cloud chamber shop and laboratory and the student shop. The physics shop provides personnel and facilities to aid in the construction of precision instruments and other critical experimental equipment. Current weather information is available at all times, and a file suitable for most types of synoptic and climatic research has been maintained since 1948.

Further information may be obtained from Professor Nelson Dingle, Department of Physics and Astronomy, The Ohio State University, Columbus 10, Ohio.

A tornado is simulated in the laboratory of The University of Texas.

Oklahoma Agricultural and Mechanical College

THE present meteorological program at Oklahoma A. & M. had its beginning in 1944 when four courses were offered in the Mechanical Engineering Department to meet the war demand. Since that time there has been a slow but steady growth of interest in the program until the spring of 1953 when the present department was officially established by the college.

The staff of the department consists of three professional meteorologists, all with exceptionally fine experience in the field of meteorological teaching and in industrial and military meteorology. An official observer and a technician for preparing and reproducing appropriate weather maps and charts are also employed by the department.

The physical plant consists of an entire floor of 5,200 square feet constructed to order for meteorological training. Adequate theory classrooms and laboratory space for 80 students are available. The duplicating room is equipped with the largest multigraph offset press, and automatic "Ditto" machines both spirit and gelatin types. The weather station and observatory possess the standard meteorological instruments plus a pyrheliometer and recorder and are served by teletype drop service C. Current weather maps, both surface and upper-air, are plotted and analyzed each day. The historical files consist of the complete daily surface and upper-air observational data for North America, and daily surface and upper-level maps and local raobs for the past five years.

Courses in descriptive meteorology, weather observations and mapping, micro-climatology, dynamic meteorology, synoptic theory and laboratory, both elementary and advanced, totalling 36 semester credit hours are offered by the department. Other departments offer courses in climatology and atmospheric physics. A terminal program on the technical level is available as a minor, and it is planned to offer a B.S. degree in meteorology in the near future.

Present research consists of an official project studying suitable methods for the evaluation of cloud seeding. Projects on tornado cloud dissipation and the application of meteorological forecasting to special types of agricultural interests are being planned.

The department has conducted a ten-month training program for 121 Air Force meteorological technicians in the past and has recently been named as one of the departments to offer basic weather training to Air Weather Service officers.

Persons interested in further details and information should write to William E. Hardy, Head, Department of Meteorology, Oklahoma A. & M. College, Stillwater, Oklahoma.

Oregon State College

INSTRUCTION in meteorology is available in the School of Science at Oregon State College, Corvallis. Though the formal curriculum at the present time is limited, there are ample opportunities for student activity in study and research under the aegis of trained meteorologists.

Meteorology instruction and research are conducted under the direction of the Department of Physics. Two of the current staff members are professional members of the American Meteorological Society and are active in many projects of importance to the people of Oregon that concern our climate and daily weather.

Three courses are offered in meteorology by the department: Rudiments of meteorology (one hour), Basic meteorology (three hours) and Meteorology, advanced (three hours per semester). College physics are prerequisites for the last two courses. In addition, the following courses in closely related subjects are given by other departments: Physical geography (climatology and land forms) and Hydrology (with laboratory).

Staff members are currently conducting research in the evaluation of a cloud-seeding program in north central Oregon and in the measurement of atmospheric ozone. Research in the department has been conducted on the potentialities of atmospheric pollution in Oregon. Staff members have given consultation in the investigation of fluoridation by industrial smokes and also have assisted in the drafting of Oregon's new set of regulations to control weather modification activities.

A roof-top Skylab has been outfitted for weather observations. Radar equipment has been installed and is now available for mete-

orological research. Ionosphere measurements have been made, and facilities exist for the expansion of this work. IBM facilities are currently being expanded at Oregon State College, so data can be quickly processed.

In addition to resident instruction, a series of courses is given by the Correspondence Study of the Oregon State System of Higher Education. These are written and conducted by faculty members of our department.

Students who are interested in further details of the opportunities in meteorology should address their requests to: E. A. Yunker, Chairman, Department of Physics, Oregon State College, Corvallis, Oregon.

The Pennsylvania State College

THE meteorology program at Penn State was started in 1935 and now leads to B.S., M.S., and Ph.D. degrees. The current staff of the Division of Meteorology consists of nine full-time faculty members, five part-time research workers, and two secretaries. Visiting professors occasionally augment the teaching staff for special courses.

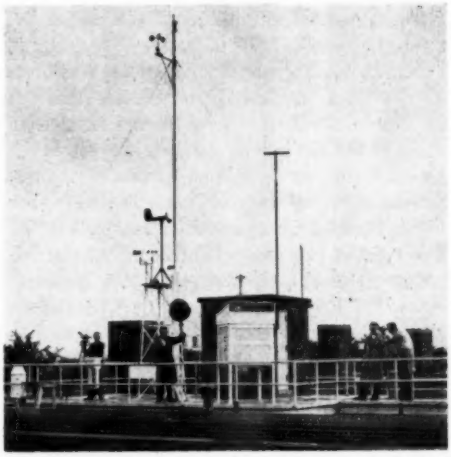
The laboratories and an adjoining observatory are equipped for instruction in all phases of meteorology and climatology. For the preparation of weather maps and practice forecasting, hourly and six-hourly synoptic reports are obtained via teletype. Numerous cloud photos, lantern slides, and motion pictures are available as visual aids. A branch library in the Mineral Industries Building contains all major foreign and domestic texts, monographs, and periodicals on meteorology and allied subjects; a large collection of reprints and research reports is maintained by the division.

Cloud chambers, cryostat, dust-, nuclei- and pollen samplers, optical and electron microscopes, x-ray diffraction apparatus, mass spectrograph, etc., are at the disposal of graduate students for investigation into cloud physics, atmospheric suspensions, air pollution, and related problems. Statistical studies of turbulence and synoptic problems are facilitated by several calculating machines, Keysort punched-card devices, and a complete IBM laboratory. For synoptic studies a microfilm collection of surface and upper-air charts, the U. S. Weather Bureau historical map series, etc., are available. In addition to local weather records dating back to 1884, the records from other stations in this country and abroad are on file for use in climatological investigations. The U. S. Department of Agriculture operates a microclimatological station on the campus, and its facilities are available for graduate research. A machine shop staffed by instrument makers is at the disposal of those who wish to construct special instruments. For optical, electrical, and bioclimatological research, respectively, ultraviolet dosimeters and integrators, polariscopes, photometers, electrometers, pyrheliometers, etc., are available.

Candidates for advanced degrees have the opportunity of choosing research topics that cross departmental lines; collaboration is assured with other departments such as Geophysics, Engineering, Agronomy, Physics, Astronomy, and the Ionosphere Research Laboratory.

For information about fees, admission requirements, general and graduate catalogues write to: Dean of Admissions, The Pennsylvania State College, State College, Pa.; for other information: Chief, Division of Meteorology, School of Mineral Industries, State College, Pa.

The division also offers a complete program of meteorology correspondence courses for college credits. For particulars write to: Correspondence Instruction Department, Central Extension Annex, The Pennsylvania State College, State College, Pa.



The weather station at The Pennsylvania State College.

Rutgers University

THE Department of Meteorology at the College of Agriculture of Rutgers University was established in 1946. The staff consists at the present time of the department head and one assistant professor. The department does not train forecasters but specializes in the rather neglected field of climatology in all its ramifications and applications.

Students are requested to take courses in elementary meteorology and climatology, the climates of the United States, in microclimatology and applied climatology, agronomy, and statistics. Since the emphasis of the entire training is on agricultural climatology, a special program is prepared for each graduate student which, whenever the student's background makes it feasible, includes some experimental work in a biological science (for instance, plant physiology). The courses comprise both the descriptive and explanatory features of global climates with special emphasis on the United States. Graduate students are requested to take a ninety-hour course in applied climatology (agriculture, forestry, city climate, medical and industrial climatology, housing, etc.).

The department grants the degree of Master of Science. In most cases our graduate students received a Bachelor's degree in meteorology from one of the larger universities with fully equipped synoptic facilities. In all cases the candidates are, in their own interest with respect to future jobs and to a well-rounded education, requested to secure, before being admitted to Rutgers, training in dynamical and synoptic meteorology equivalent to that requested to receive Master's degrees in the larger departments of meteorology. Mathematical courses on all levels are available here, but no advanced courses in theoretical or synoptic meteorology.

The student has to submit a Master's thesis. The type of problems is indicated by the following titles of some theses written in recent years: "A Preliminary Dynamic Climatology for New Jersey and its Applications to Human Activities"; "The Drought Index in the United States"; "A Study of Certain Thermal Features of the Climate of New Jersey" (primarily genetic frost types and continentality); "Wind Conditions in New Jersey." While the department does not grant the Ph.D. degree, students may receive their degrees from other departments of Rutgers while working on microclimatic problems, or from another university which asked this department to sponsor the thesis (topics: "Aspects of the Vertical Temperature Distribution Within the Layer of Air Near the Ground"; "Vegetation and Microclimates of Northern and Southern Slopes in New Jersey"). Many graduate students attending our courses are majoring in botany, farm crops, soils, sanitation, etc. They need detailed knowledge in microclimatology for studies in ecology, selection of crop strains, city pollution and purification, etc.

Interested students are invited to write for full details to A. V. Havens, Assistant Professor, Department of Meteorology, College of Agriculture, Rutgers University, The State University of New Jersey, New Brunswick, New Jersey.

Saint Louis University Institute of Technology

METEOROLOGY has had a long, though discontinuous, history in Saint Louis University. In 1835, fifty-six years before the organization of the U. S. Weather Bureau, Father Judocus Van Sweevelt, S.J., began to make meteorological observations five times a day. After his death there was a lapse until 1860 when a complete meteorological observatory was set up at the University and continuous records were kept until 1876, when a government station was established in the vicinity.

In 1909 a new meteorological observatory with complete modern equipment was established at its present site and training in meteorology was begun by Father John Bernard Goesse, S.J., and Brother George E. Rueppel, S.J. In 1925 its administration together with that of the seismological station and all teaching functions in the meteorological and geophysical field were taken over by the Department of Geophysics.

The University currently confers the degrees of Bachelor of Science in Professional Meteorology, Master of Science in Meteorology, and Doctor of Philosophy in Geophysics with emphasis on meteorology. Courses offered are: (1) Undergraduate (senior year): meteorological observations

laboratory, meteorological instruments, synoptic meteorology, synoptic meteorological laboratory, climatology, statistical climatology, dynamic meteorology, hydrometeorology, hydrology, vector analysis, hydrodynamics, and thermodynamics; (2) Graduate: synoptic meteorology of the Northern Hemisphere, dynamic meteorology and synoptic applications, extended forecasting, tropical meteorology, turbulence, radiation, evaporation, and precipitation.

Besides the usual standard meteorological equipment and special apparatus, such as highly sensitive microbarographs, the University has teletype drops on A & C weather circuits, which permit the plotting of daily maps and charts. These maps and charts are duplicated by means of a large Bruning White printer for immediate use in the laboratory. The University also conducts an Air Weather Officers training program.

Special opportunities are available for research in such fields as synoptic meteorology, hydrometeorology, microbarisms, micrometeorology, and the applications of microseisms to meteorology.

For further information write: The Dean, Saint Louis University, Institute of Technology, 3621 Olive Street, Saint Louis 8, Missouri.

Saint Louis University Parks College of Aeronautical Technology

THE curriculum in aeronautical meteorology at Parks College was first offered at the technical institute level in 1937 with Dr. C. E. Buell as the first full-time instructor. In 1946, upon becoming one of the undergraduate schools of Saint Louis University, a program was presented at the senior level leading to the degree of Bachelor of Science in Aeronautics.

The course of study is intended to train airline forecasters. Classes are small—they average from seven to ten students, and one full-time instructor, Mr. Walter Roschke, is assigned to the curriculum. Prerequisites are: mathematics through differential equations, eight semester hours of college physics, four semester hours of engineering mechanics, four semester hours of drafting, four semester hours of statistics, and the usual Jesuit college prerequisites of English, philosophy, history, and economics. These are offered on the Parks College campus through regular University departments.

In the senior year students take several specialized subjects in air transportation, such as communications, airline traffic, economics of air transportation, airport management, and air transportation laboratory. The degree is Bachelor of Science in Aeronautics with concentration in aeronautical meteorology.

There is a well-equipped laboratory with teletype drops. A library contains a file of weather maps dating back to 1889 as well as many books and bound periodicals. The library facilities of the Institute of Technology of Saint Louis University are readily accessible. Students are required to prepare senior theses. A cold box and precipitation chamber are available for experiments.

For further information write: Dean Niels C. Beck, Parks College of Aeronautical Technology, Saint Louis University, Parks Airport, East Saint Louis, Illinois.

Agriculture and Mechanical College of Texas

THE Department of Oceanography was established in the School of Arts and Sciences in 1949 in response to a need for an integrated program of the sciences of the sea and for undertaking vital studies of the Gulf of Mexico. Subject matter in the department is divided into five major phases: physical, biological, geological, chemical, and meteorological, the last of which deals with the relation of ocean and atmosphere.

Initially, courses in oceanography were given at the senior and graduate levels only, leading to the Master of Science and Doctor of Philosophy degrees in each of the five phases of the field. A complete undergraduate program is now offered for the Bachelor of Science degree in the meteorology option. It provides a well-rounded basic course of study in meteorology, as preparation for the ad-

vanced work in meteorological oceanography, and also serves as preparation for professional employment and for graduate study in meteorology.

Graduate work in meteorological oceanography involves marine meteorology and, in its broader aspects, the application of meteorological science to problems of the sea. With previous formal training in meteorology, the Master of Science degree program can include eight semester hours of advanced meteorology, six semester hours of related physical oceanography, and research in marine meteorology.

The department has 14 faculty members, eight of whom are concerned with meteorological instruction. Several additional meteorologists are members of the staff of the Texas A and M Research Foundation and are available for lecturing and consulting. Activities in sponsored meteorological research include work on the interaction of ocean and atmosphere, upper-level winds, severe storms, and a state-wide tornado warning service.

Campus facilities for meteorological instruction and research include ordinary weather station equipment, teleprinter reception of weather data, and the college library with American and foreign scientific periodicals and published daily series of weather charts. The meteorological facilities of Easterwood Airport and Bryan Air Force Base are within a short distance of the campus. A radar modification program, conducted in cooperation with the U. S. Weather Bureau, is to be centered on the campus. Climatological stations and records of the Texas Agricultural Experiment Station are available for instruction and applied research. Onshore and offshore installations near the Gulf coast are equipped and maintained for marine and meteorological investigations. The recently acquired 120 foot auxiliary schooner ATLANTIC, on which marine meteorological equipment is being installed, will be operated on cruises over the Gulf of Mexico and adjacent ocean areas.

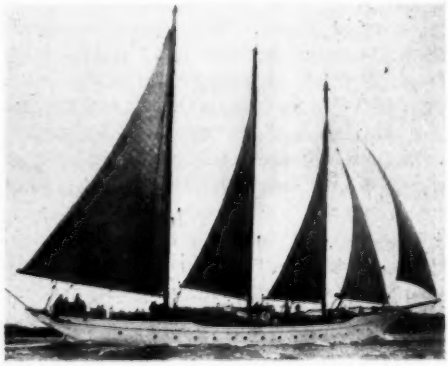
Persons interested in educational opportunities offered by the department are invited to write the Head, Department of Oceanography, A & M College of Texas, College Station, Texas.

The University of Texas

THE present meteorology program at The University of Texas was begun in September, 1946, with modest course offerings in general and descriptive meteorology. Professional meteorologists employed by the Electrical Engineering Research Laboratory for research in radio meteorology recognized the need for course work to complement the research, and it was through their efforts that the present program was begun. Administratively, the program is connected with the Department of Aeronautical Engineering of the College of Engineering.

In September, 1950, the course offerings were expanded into a professional curriculum leading to the degree of Bachelor of Science in Meteorology, involving 143 semester hours of required and elective courses. The curriculum covers the fundamental principles of meteorology, including thermodynamics, physics, and hydrodynamics of the atmosphere. Also included are synoptic meteorology (weather analysis and forecasting), principles and operation of meteorological instruments, and fundamentals of climatology. Laboratory work coordinates and applies the meteorological principles taught in the lecture courses. A total of 17 different courses is currently available.

Facilities for training include adequate lecture and laboratory space. Weather teletype machines provide current weather reports from about 500 stations in the U. S., Canada, Mexico, and adjacent ocean areas. This information is filed for use in student weather



The oceanography research ship, Schooner A. A. Jakkula, at Texas A & M College.

analysis and staff research. Both standard meteorological instruments used in routine weather station observations and specialized instruments used in research are available. Library facilities are excellent, with most of the standard texts, periodicals, and references now available on Engineering Library shelves.

The present staff consists of Assistant Professors Kenneth H. Jehn and Raymond C. Staley, both of whom hold Master's degrees and are professional meteorologists. In addition, John R. Gerhardt, assistant director of the Electrical Engineering Research Laboratory, is a professional meteorologist who devotes his time principally to research activities.

Research work in meteorology and related fields is carried on primarily through the Electrical Engineering Research Laboratory, where numerous contracts with various federal agencies are administered. Research of a meteorological nature includes studies of the atmosphere near the ground as related to the propagation of very short radio waves. Among the unconventional instruments devised at the laboratory in these studies is the Crain refractometer, a device for measuring directly the index of refraction of atmospheric air.

Among the strictly meteorological activities is a contract with the Geophysical Research Directorate of the U. S. Air Force for the development and operation of an instrument to measure the flow of heat into and out of the soil. The latest model of this instrument, called a heat meter and based on early work done by F. Albrecht in Germany, was field tested in the Great Plains Micrometeorological Field Experiment during August and September this year.

Another study involves the local climate of the immediate Austin, Texas, area. Principal measurements thus far have been of temperature variations in and around the urban area. Data provided by such climatological studies are useful in city planning, as well as in the design and construction of buildings, whether they be office buildings in the downtown area or homes in the suburbs.

Further information on the meteorology curriculum or the research activities should be directed to Professor Kenneth H. Jehn, E. D. Hall 101, The University of Texas, Austin 12, Texas.

University of Utah

THE University of Utah's Meteorology Department was established in 1947, and granted its first Bachelor of Science degree in June 1948. The first Master of Science degree was granted in June 1951. The Doctor of Philosophy degree is not offered at this time, although students majoring in other departments may complete doctoral minors in meteorology.

Currently, the department has two faculty members, Assistant Professor Aylmer H. Thompson and Associate Professor J. Vern Hales, department head, as well as graduate assistants.

As classes are small, personal relationships between students and faculty are informal and friendly. The growth of the individual student is encouraged by working with other students and faculty members in classes as well as in laboratories. Students have participated in the installation of all departmental equipment, and have assisted in designing and constructing many of the facilities as a part of the teamwork learning of the laboratory courses.

The laboratory includes a complete Navy shore type weather station with the same type instruments currently in use at large Naval Air Stations. This station was loaned to the Meteorology Department by the Naval R.O. T.C. Unit of the University of Utah and was installed by the first senior class. A large versatile calibration chamber, capable of independent temperature, pressure, and humidity control, was designed by the next two classes and partially completed by subsequent classes. In addition to completing the calibration chamber, this year's class will set up new micrometeorological equipment elsewhere on the campus.

The synoptic laboratory is equipped with individual tracing tables for each student, permitting free instructional usage of graphical addition or other similar techniques.

Although the departmental course offering retains emphasis on the standard senior courses in synoptic and dynamic meteorology, four deviations are worthy of note: First, meteorology is among the engineering departments of the College of Mines and Mineral Industries, which permits graduation require-

ments to be set at 212 quarter hours credit, including specific courses. Second, the junior student enrolls in upper division mathematics, upper division physics, and upper division meteorology courses (climatology, synoptic, physical), which permits him to enter the senior year with an improved perspective. Third, senior students and sometimes juniors enroll in a seminar course in which they review one or two scientific papers per quarter under the close supervision of the staff, thus gaining ability at oral presentation as well as increasing their familiarity with the scientific literature. Fourth, the schedule of required courses includes many opportunities for "approved technical electives," which permit students to develop individual fields of interest.

Graduates of the University of Utah's Meteorology Department are employed in various fields of meteorology—about one-third in synoptic meteorology or airways forecasting, one-third in hydrological meteorology, and one-third in physical meteorology or other specialized fields.

Persons interested in additional information should address: Dr. J. Vern Hales, Department of Meteorology, University of Utah, Salt Lake City 1, Utah.

University of Washington

THE Department of Meteorology and Climatology, which offers both undergraduate and graduate work, was established in 1947. Three degrees, the B.S., M.S., and Ph.D., can be granted. The staff is composed of five men: P. E. Church, R. G. Fleagle, F. I. Badgley, W. L. Schallert, and E. P. McClain, with a sixth being added this fall.

The department is housed in a separate building containing classrooms, laboratories, offices, research space, photographic darkroom, and drafting room. The building is so arranged that the synoptic section, both undergraduate and graduate, is a compact unit with the teletypes and Bruning duplicator being immediately accessible. Another compact unit is the instrument section with a laboratory, having water, gas, compressed air, D.C. and A.C. current available and an adjacent machine shop with precision lathe and a drill press.

Air Force training program at Oklahoma A & M College.

On the lower campus is the tower-mast unit, 165 feet high, from which air temperatures from nine levels, wind speed from eight levels, wind direction from four levels, dewpoint from eight levels, and soil temperatures from 13 depths down to 50 feet have been constantly recorded for the past two to five years. Incoming solar radiation is also recorded; the department is the official United States Weather Bureau solar radiation station for Seattle.

Undergraduate courses provide ample training to prepare students to receive the rating of professional meteorologist given by the United States Civil Service Commission. This training consists of one year of climatology (physical, regional, and micro), one year of physical meteorology and beginning dynamics, one year of synoptic laboratory with two quarters of lectures on synoptic meteorology, a course on atmospheric thermodynamics, and one on instruments and observations.

In graduate work, which is being expanded as staff increases, all standard courses on dynamics, advanced synoptic analysis, and seminar are offered; specialties of atmospheric turbulence, polar meteorology, meteorological statistics, and oceanographic meteorology are currently given. The latter is a summer course emphasizing the interaction of atmosphere and sea; it has field work which is performed both on a raft and on the research vessel, the "Brown Bear."

Because of the unique tower and its equipment, much of the research is centered on the various characteristics and parameters of the lower layers of the atmosphere.

The department is building a mobile observing unit for the Munitalp Foundation to make standard and special observations, has a number of contracts with various governmental agencies, and cooperates with other departments in allied fields in working on problems.

For further information address correspondence to P. E. Church, Executive Officer, Department of Meteorology and Climatology, University of Washington, Seattle 5, Washington.

University of Wisconsin

THE University of Wisconsin established a Department of Meteorology in 1948, its centennial year, with a faculty of two. The initial purpose was to provide training and research in the general field of applied meteorology, and since that time the department has devoted a major portion of its effort to research.

At present the department consists of three teaching professors and five full-time research associates plus a variable number of graduate research assistants. Despite the emphasis on research, the B.S. and M.S. degrees are regularly offered, and the Ph.D. degree is offered under the direction of a graduate school committee.

With a small faculty the department aims to give high-grade graduate instruction in its specialties rather than in the entire broad field of meteorology. These areas of specialization are instrumentation, micrometeorology, physical limnology, and dynamic climatology. Forecasting is not emphasized. At the undergraduate level the curriculum emphasizes mathematical and physical background rather than numerous courses in meteorology as such.

Classes are small, but facilities are excellent. A well-equipped instrument laboratory, a micrometeorological field station, a mobile micrometeorological unit, boat and gear for lake work, and two weather radar units are included in these facilities. In addition complete IBM facilities and hydraulic laboratories are available for student use.

Throughout the past five years there has been close association in research and teaching between meteorology and agriculture, electrical engineering, botany, zoology, geology, geography, sanitary engineering, and hydraulic engineering. Unusual opportunities are offered the student interested in the border areas of these disciplines.

Research assistantships for qualified students are usually available. For further information write Dr. R. A. Bryson, chairman of the Department of Meteorology, University of Wisconsin, Madison 6, Wisconsin.

Dr. Petterssen, director of the Weather Forecasting Research Center, briefs Weather Bureau officials and staff at The University of Chicago.

WEATHER BUREAU CAREERS

(Continued from page 119)

Weather Bureau. General Service Meteorologists in the hydrological program participate with senior meteorologists in forecasting river stages and issuing warnings of flood conditions in the various river district areas. Other specialities such as the fire-weather, fruit-frost, and hurricane services also utilize the assistance of General Service Meteorologists.

Advancement from the GS–7 General Service Meteorologist positions leads to more specialized fields in the career of the Weather Bureau meteorologist. With increased responsibilities, the various options in meteorology become more detailed in their demands and the full-time participation by an employee in a single field becomes necessary. The accompanying chart shows the wide range of positions found in the Weather Bureau. Employees with well-rounded work experience are often reassigned to different positions within the same grade level.

Supervisory positions are found in all professional grades of the Bureau, GS–7 and above. When selecting meteorologists for supervisory positions, the Bureau looks to those who have demonstrated leadership abilities in addition to technical competence. Most of the employees charged with supervisory responsibilities are what might be called "working supervisors." They continue to be engaged in the work of the unit which they supervise. For example, a Supervising Aviation Forecaster when preparing the schedule of tours-of-duty for his unit will assign himself to one of the forecast shifts. He thereby continues to participate in the aviation forecast program of the station as well as to carry on his duties of technical leadership in group discussions, studies, and research on forecast improvement. In the same manner, practically all supervisors continue to gain working experience while they enjoy the advantages of their supervisory positions.

At the field stations, the top supervisory position is that of Meteorologist in Charge, who, in addition to being responsible for the entire weather program at his station, represents the Weather Bureau in dealing with civic leaders and representatives of various private enterprises such as the press, radio stations, airlines, agricultural associations, etc. Because of this, the "MIC" position provides prestige for the employee in his relationships with other Bureau personnel and with his community and neighbors. The grades of these Meteorologists in Charge are commensurate with the size and responsibilities of the field stations they head. Therefore, the chart indicates that these positions are found at all grades GS–9 and above. The higher the grade, the more desirable it is that the incumbent have a fully-rounded experience.

A background of varied experience within the Bureau is even more important when it comes to selecting candidates for management and staff positions in the Central Office and Regional Offices. To plan and administer the weather programs that comprise the broad responsibilities of the Bureau requires a combination of technical background, broad experience, and demonstrated initiative.

Each summer the Weather Bureau employs a limited number of sophomore and junior college students entered for degrees in meteorology. Successful candidates are given on-the-job training during the summer months as full-time Weather Bureau employees. Leave without pay is granted during the school year. Upon completion of a bachelor's degree in meteorology, they are assigned to full-time positions as Meteorologist Trainees as described earlier in this article.

While positions in professional meteorology offer the broader fields as far as a career is concerned, the Weather Bureau employs about an equal number of nonprofessional personnel in meteorology. Candidates for these Meteorological Aid positions must be high school graduates who have pursued a curriculum including good courses in mathematics and physical sciences, more specialized than "general science."

Meteorological Aids take and transmit scheduled weather observations, both surface and upper-air, and plot a variety of meteorological charts from coded data received from other stations. They are also responsible for noting and reporting significant changes in weather conditions as they occur. These "special" observations are invaluable to forecasters, who must keep up-to-the-minute flight forecasts, as well as tornado, hurricane, and other storm warnings. The Mete-

(Continued on page 150)

THE AMERICAN METEOROLOGICAL SOCIETY

The objectives of the American Meteorological Society are "the development and dissemination of knowledge of meteorology in all its phases and applications, and the advancement of its professional ideals." The organization of the Society took place in affiliation with the American Association for the Advancement of Science at Saint Louis, Missouri, December 29, 1919, and its incorporation occurred at Washington, D. C., January 21, 1920. The work of the Society is carried on by its publications, by papers and discussions at national meetings, local branch activities, the library, and through the central office of the Executive Secretary.

OFFICERS FOR 1953

President: HORACE R. BYERS, Sc.D., Professor and Chairman, Department of Meteorology, The University of Chicago, Chicago, Ill.

Vice President: BENJAMIN G. HOLZMAN, M.S., Colonel, U.S.A.F., Director of Research and Development, Special Weapons Center, Kirtland Air Force Base, Albuquerque, N. M.

Secretary: CHARLES F. BROOKS, Ph.D., Professor of Meteorology, Harvard University, and Director, Blue Hill Observatory, Milton, Mass.

Treasurer: HENRY DEC. WARD, A.B., Vice-President, Eaton and Howard, Inc., Investment Managers, Boston, Mass.

Executive Secretary: KENNETH C. SPENGLER, A.B., 3 Joy St., Boston 8, Mass.

MEMBERSHIP

Corporation membership is open to commercial enterprises and educational institutions interested in the advancement of meteorology. Dues are $100 per year.

Professional membership is designed for those with special qualifications in experience or training, or who have made contributions to meteorology. Dues are $12 per year.

Regular membership is open to those whose interests or activities in meteorology or climatology would make them desirable members of the Society. Dues are $7 per year.

Student membership is maintained for graduate or undergraduate students who are specializing in meteorology. Dues are $5 per year.

Associate membership offers affiliation with the Society to those whose interests are primarily of an amateur nature. Dues are $3 per year.

PUBLICATIONS

Bulletin of the American Meteorological Society
Journal of Meteorology
Meteorological Monographs
Weatherwise
Meteorological Abstracts and Bibliography
Compendium of Meteorology

NATIONAL MEETINGS IN 1954

New York City, 25–28 January
Baltimore, 3–5 May
Pullman, Wash., mid-June
Columbus, Ohio, 21–23 September
Miami, Florida, early December

For full information on all activities of the Society, write to the Executive Secretary, 3 Joy Street, Boston 8, Massachusetts.

A Selected Bibliography in Meteorology

POPULAR: Fisher, R. M., *How to Know and Predict the Weather.* (Original title: *How About the Weather?* Harpers, 1951.) A Mentor Book, M84. The New American Library of World Literature, Inc., New York, 1953. 167 p. 35¢. Covers the elementary physics of the atmosphere plus material on forecasting from newspaper maps and local signs. Sixteen illustration plates.

Hare, F. K., *The Restless Atmosphere.* Hutchinson's University Library. Longmans, Green and Co., Inc., New York, 1953. 192 p. $2.40. (Textbook edition—$1.80.) Contains a brief review of the physical laws governing weather processes, then treats the principal regions of the earth in terms of dynamic climatology.

Haynes, B. A., *Techniques of Observing the Weather.* John Wiley & Sons, New York, 1947. 272 p. $4.50. Descriptions and illustrations of principal Weather Bureau instruments, with instructions for making and recording observations.

Inwards, R., *Weather Lore,* 4th ed. Edited by E. L. Hawke, Rider and Co., London, 1950. 251 p. $2.10. The classical collection of sayings and proverbs on weather lore. Republished for the Royal Meteorological Society.

Longstreth, T. M., *Understanding the Weather.* (A revision of *Knowing the Weather,* 1943.) The MacMillan Company, New York, 1953. 118 p. 13 cloud photos. $2.50. A very lively and readable account of the behavior of the weather elements. Recommended as a first book on the weather.

Ludlum, D., ed., *Amateur Weatherman's Almanac.* Weatherwise, Franklin Institute, Philadelphia 3, Pa., 1952—. $1.00. An annual, first published in 1952, that summarizes the interesting weather events of the past year. Fully illustrated. Handbook section for amateur observers. Contains monthly blank recording forms.

Miller, D., *Wind Storm and Rain. The Story of Weather.* Coward-McCann. New York, 1952. 177 p. $3.95. A series of well-written, up-to-date essays on what makes up our daily weather.

Schneider, H., *Everyday Weather and How It Works.* McGraw-Hill Book Co., New York, 1951. $2.75. An explanation of the daily weather processes with instruction for making simple weather instruments. Recommended for junior and senior high schools.

Sloane, Eric. *Eric Sloane's Weather Book.* Little, Brown and Company, Boston, 1952. 90 pages. 80 illustrations. $3.95. A coordinated collection of Eric Sloane's well-known weather illustrations and cartoons with appropriate text. Will be appreciated by all ages.

Tannehill, I. R., *Weather Around the World.* 2nd ed. Princeton University Press, Princeton, 1951. 212 p. $3.50. A description of normal weather at sea and in port for the world traveller.

Wilson, V. and Berke, J., *Watch Out For The Weather.* The Viking Press, New York, 1951. 256 p. $2.95. An account of how the weather and climate affect your health and daily life.

Yates, R. F., *Weather for a Hobby.* Dodd, Mead and Co., New York, 1946. 172 p. $2.75. Deals mainly with all types of amateur instrument making, with full plans for a home observatory.

ELEMENTARY TEXTS: Blair, T. A., *Weather Elements*. 3rd ed. Prentice-Hall, New York, 1948. 373 p. $5.65. School edition $4.25. A basic text of long standing.

Donn, W. L., *Meteorology with Marine Applications*. 2nd ed. McGraw-Hill Book Co., New York, 1946. $6.25. Written from the point of view of the deck officer.

Kraght, P. E., *Meteorology for Ship and Aircraft Operation*. Cornell Maritime Press, Cambridge, Md., 1944. 384 p. $3.50. A good text for all-around purposes.

Neuberger, H., *Introduction to Physical Meteorology*. The Pennsylvania State College, State College, Pa., 1951. 271 p. $3.50. Provides a basic understanding of the physical principles where most texts are weak. Recommended for all basic courses.

Neuberger, H., and Stephens, F. B., *Weather and Man*. Prentice-Hall, New York, 1948. 281 p. $5.00. An introductory text is followed by a description of how weather affects man in his private and business life. Especially good for survey courses.

Petterssen, S., *Introduction to Meteorology*. McGraw-Hill Book Co., New York, 1942. 236 p. $4.50. An admirably concise presentation of the basic physical principles on which modern forecasting is based.

ADVANCED TEXTS: Brunt, D., *Physical and Dynamical Meteorology*. 2nd ed. Cambridge University Press, Cambridge, 1952. 428 p. $9.00. The standard reference in this field. Highly mathematical.

Byers, H. R., *General Meteorology*. McGraw-Hill Book Co., New York, 1944. 645 p. $7.00. A well-balanced college text with due emphasis on aeronautical aspects.

Hewson, E. W. and Longley, R. W., *Meteorology, Theoretical and Applied*. John Wiley & Sons, Inc., New York, 1944. 468 p. $6.00. A well-balanced college text by two eminent Canadian scientists.

Petterssen, S., *Weather Analysis and Forecasting*. McGraw-Hill Book Co., New York, 1940. 505 p. $8.00. A textbook on synoptic meteorology. Principles of the physical, dynamic, and kinematic atmosphere are discussed with their applications to weather forecasting.

Willett, H. C. *Descriptive Meteorology*. Academic Press, New York, 1944. 310 p. $6.00. Treats the theories of the general circulation of the atmosphere. Strong on air masses and North American weather types. Useful to the non-mathematically inclined as well as to the serious student.

HANDBOOKS: Berry, Bollay, and Beers. *Handbook of Meteorology*. McGraw-Hill Book Co., New York, 1945. 1,116 p. 730 illus. $12.00. A survey of the entire field of meteorology.

Malone, T., ed., *Compendium of Meteorology*. American Meteorological Society, Boston, 1951. 1,334 p. $12.00. Contains 108 articles which survey the present status of the subject and make suggestions for future progress. Indispensable as a reference work for the student of meteorology.

Shaw, N., *Manual of Meteorology*. 4 vols. Cambridge University Press, Cambridge, 1926–34. 1619 p. $32.00. A survey of meteorology in the late 1920s. Contains much descriptive, historical, and theoretical matter that is found nowhere else.

WORKBOOKS: Caudle, F. L., *Workbook in Elementary Meteorology*. McGraw-Hill Book Co., 1945. 191 p. $2.20. Problems, quizzes, and map drawing exercises.

Kraght, P., *Meteorology Workbook with Problems*. Cornell Maritime Press, Cambridge, Md., 1943. $2.50. Problems, quizzes, and map drawing exercises.

Pulk, E. S., and Murphy, E. A., *Workbook for Weather Forecasting*. Prentice-Hall, Inc., New York, 1950. 66 p. with kit of 30 practice charts. $5.00. Contains instructions for plotting and analyzing synoptic weather maps along with a discussion of forecasting methods.

CLIMATOLOGY: Brooks, C. E. P., *Climate in Everyday Life*. Philosophical Library, New York, 1951. 314 p. $4.75. A discussion of the climate factors and how they affect our daily life and business.

Brooks, C. E. P., *Climate Through the Ages. A Study of Climatic Factors and Their Variations*. McGraw-Hill Book Company, New York, 1949. 395 p. $4.50. A survey of climate and weather conditions from geologic times to the present. Good material on current climate changes.

Haurwitz, B., and Austin, J. M., *Climatology*. McGraw-Hill Book Co., New York, 1944. 410 p. $8.00. A survey of the elements that make up our climate and a regional account of the world's climate zones. The approach is from the dynamic climatology viewpoint with much on air masses and disturbances.

Kendrew, W. G., *Climatology*. 3rd ed. Oxford, Clarendon Press, London, 1949. 383 p. $7.50. A revision of the standard work in the field.

SPECIAL SUBJECTS: Flora, S. D., *Tornadoes*. Oklahoma University Press, Norman, 1953. 208 p. $3.50. A descriptive summary of all we know about tornadoes. Lists by states of all principal tornado occurrences.

Geiger, R., *The Climate Near the Ground*. Harvard University Press, Cambridge, 1950. 482 p. $5.00. A translation of the famous work summarizing Dr. Geiger's work in Germany in micrometeorology.

Linsley, Kohler, and Paulhus, *Applied Hydrology*. McGraw-Hill Book Co., New York, 1950. 689 p. $8.50. The story of rainfall and its effects on topography by three meteorologists.

Perrie, D. W., *Cloud Physics*. John Wiley & Sons, New York, 1950. 119 p. $4.50. An account of the physical characteristics of clouds with a limited amount of information on artificial modification of clouds.

Sutton, O. G., *Micrometeorology*. McGraw-Hill Book Co., New York, 1953. 343 p. $8.50. A survey with emphasis on theory.

Tannehill, I. R., *Drought. Its Causes and Effects*. Princeton University Press, Princeton, 1947. 246 p. $3.00.

Tannehill, I. R., *Hurricanes*. 7th ed. Princeton University Press, Princeton, 1950. 304 p. $3.00.

U. S. Weather Bureau, *The Thunderstorm*. Government Printing Office, Washington, 1950. 287 p. $2.25. A summary of the findings of the Thunderstorm Project.

Meteorological Periodicals in English

UNITED STATES:

Bulletin of the American Meteorological Society. Monthly (except July and August). Now in v. 34, no. 8, October 1953. Annual subscription $8.00 to non-members: American Meteorological Society, 3 Joy St., Boston 8, Mass.

Journal of Meteorology. Bi-monthly. Now in v. 10, no. 5, October 1953. Annual subscription to non-members $8.00: American Meteorological Society, 3 Joy St., Boston 8, Mass.

Meteorological Abstracts and Bibliography. Monthly. Now in v. 4, no. 10, October 1953. Annual subscription $9.00; individual issues $2.00: American Meteorological Society, 3 Joy St., Boston 8, Mass.

Monthly Weather Review. Monthly. Now in v. 81, n. 10, October 1953. Annual subscription (domestic) $3.50; foreign $4.50. Published by the United States Weather Bureau. Subscription office: Superintendent of Documents, Government Printing Office, Washington 25, D. C.

Transactions of the American Geophysical Union. Bi-monthly. Now in v. 34, n. 5, October 1953. Published by the National Research Council. Annual subscription to non-members $9.00: American Geophysical Union, 1530 P Street, Washington 5, D. C.

Weatherwise. Bi-monthly. Now in v. 6, n. 5, October 1953. Annual subscription $3.00: American Meteorological Society, 3 Joy St., Boston 8, Mass.

GREAT BRITAIN:

The Marine Observer, a Quarterly Journal of Maritime Meteorology. Quarterly. Now in v. 23, n. 161, May 1953. Annual subscription one pound ($2.80): Her Majesty's Stationery Office, York House, Kingsway, London, W.C. 2, England.

Meteorological Magazine. Monthly. Now in v. 82, n. 973, July 1953. Annual subscription 25 shillings ($3.50): Her Majesty's Stationery Office, York House, Kingsway, London, W.C. 2, England.

Quarterly Journal of the Royal Meteorological Society. Quarterly. Now in v. 79, n. 341, July 1953. Subscription to non-members 3 pounds 1 shilling ($8.54): Royal Meteorological Society, 49 Cromwell Road, London, S.W. 7, England.

Weather. Monthly. Now in v. 8, n. 10, October 1953. Annual subscription 24 shillings ($3.50): Weather, 49 Cromwell Road, London, S.W. 7, England.

EUROPE, AFRICA, ASIA:

Geophysical Magazine. Central Meteorological Observatory of Japan. Irregular, about 4 nos. per year. Now in v. 25, 1953. No price given: Central Meteorological Observatory of Japan, Tokyo, Japan.

Indian Journal of Meteorology and Geophysics. Meteorological Department of India. Quarterly. Now in v. 4, n. 2, April 1953. Annual subscription 16 shilling ($2.25): Manager of Publications, Government of India, Delhi, India.

Notos. Weather Bureau of South Africa. Irregular. Last received v. 1, n. 4, 1952. Subscription for volume of four numbers 35 shillings ($4.90): South African Weather Bureau, P.O. Box 1135, Pretoria, South Africa.

Tellus, a Quarterly Journal of Geophysics. Swedish Geophysical Society. Quarterly. Now in v. 5, n. 1, February 1953. Subscription $6.00: Editor, Flemminggatan 103, Stockholm, Sweden.

World Meteorological Organization Bulletin. Quarterly. Now in v. 2, n. 3, July 1953. Annual subscription $1.00: World Meteorological Organization, Campagne-Rigot 1, Avenue de la Paix, Geneva, Switzerland.

Weatherwatch

The Summer Droughts

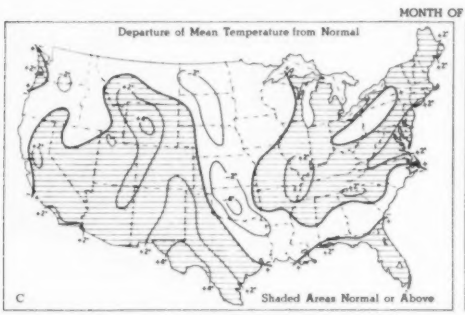
DAVID M. LUDLUM, *Editor*

DROUGHT continued to be the main feature of of the nation's weather during the summer months of 1953. In some areas of the Southwest the winter and spring dryness continued and threatened to bring complete disaster to many agricultural crops. Temporary relief came to areas in the southern Plains and middle Mississippi Valley in mid-July before a second period of extreme dryness developed in the dog days of August. And there were localities further north and east that experienced drought for the first time this year as the great anticyclonic ridge fastened its hold on the country in middle and late August.

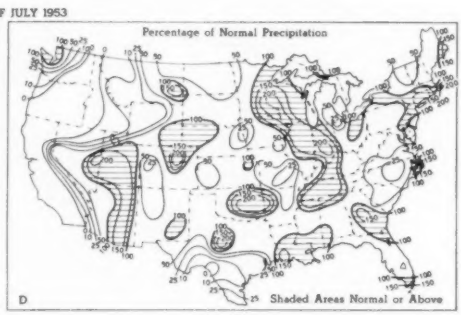
Soon after the passing of the summer solstice, welcome downpours returned to the Gulf Coast areas of Mississippi, Louisiana, and east Texas to save crops from a five-week rainless period. But further west the dry period continued well into July. Not until 12 July did Amarillo, in the heart of the Panhandle winter wheat section where only 0.01 of an inch of rain had fallen in June, did enough precipitation fall to settle the dust. During the last two weeks of July copious rains fell over the southern Plains and eastward to revive hopes that a crop of winter wheat could be planted to compensate for the short crop of 1953. South Texas, however, remained beyond the fringe of the rain area and had to wait another month, until the last decade of August, for relief. And then the rains came in the form of tropical cloudbursts that dropped as much as 15 inches in a 24-hour period, turning the Texas coast area into "almost a solid lake," according to aerial observers on the morning of 31 August.

There were two relatively small areas, however, where the drought held sway all summer and crops became an almost total loss. Southwestern Missouri remained a parched island throughout July and August surrounded by areas where shower activity was constant; less than 25 per cent of the normal precipitation fell there in the eight weeks ending 31 August. And in the Piedmont of Virginia and North Carolina another rain shadow persisted through the summer; large tobacco and corn areas had less than 50 per cent of the normal rainfall in July-August. Furthermore, the last three weeks of August witnessed the spread eastward of a large area of very light precipitation. From Iowa and Missouri eastward to the Atlantic Coast rainfall was less than 25 per cent of normal from 10–31 August, causing a great reduction of crop yields at this critical time. The summer droughts of 1953 were more widespread and intense than at any time since the dire days of the early 1930's.

The widespread nature of the drought conditions suggests that the pressure features on the mean weather maps of June, July, and August may have been static and that little change over the period could be distinguished in the type of general circulation. Such was not the case, and this emphasizes that drought can develop under a number of circulation patterns. The key to long dry periods in the central and eastern United States is the exclusion of moist Gulf air from the North American land mass. In the middle of June the anticyclonic cell at 10,000 feet, which governs our summer circulation, had been centered over Mississippi-Louisiana, and a southwesterly circulation from the arid deserts of Mexico and our Southwest brought dry air to all central and eastern sections. As July commenced, the anticyclone



Departure of mean temperature from normal in degrees F., July 1953. USWB chart.



Percentage of normal precipitation, July 1953. USWB chart.

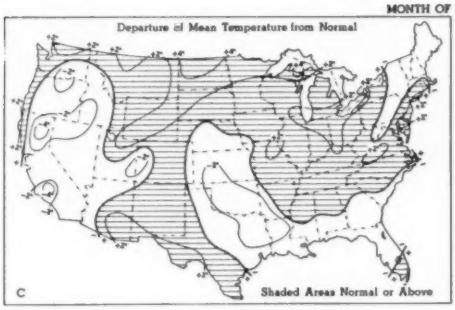
continued its migration westward and eventually formed a separate cell over east Texas, while the main extension of the Bermuda high remained poised over southeastern United States. Between these cells trough conditions developed after 10 July, cold air and cold fronts moved into the trough, and cyclones either generated here or were drawn to the area. This situation broke the drought. Cool air, flowing southward over the Plains, put an end to the long heat wave west of the Mississippi River; at the same time moist air from the Gulf of Mexico was brought northward to supply the moisture for the widespread shower activity that marked the middle days of July in the South and East.

The change in the circulation pattern was signaled by the movement of a cold front which crossed the northern border on 7 July and finally reached the Gulf Coast on 10 July, the first cold front to penetrate the area in many weeks. Good rains fell in advance and along the front in the Gulf states and northwestward over Oklahoma to Colorado. The front remained in a semi-stationary position for a number of days to bring convective rainfall to the southern Plains and lower Mississippi Valley. All drought areas there with the exception of south Texas received good rains at this time. Rainfall also spread north and northeast with traveling depressions to alleviate dryness in Atlantic Coast regions. New York City had 3.51 inches in 12 hours on 23 July, and much flooding resulted in the suburbs. The closing week of July brought a return to more anticyclonic control in the central part of the country as the trough conditions moved eastward and joined the existing trough off the Atlantic Coast. Below-normal temperatures with some seasonal records were experienced on 23–24 July, but gradual moderation took place under the rays of the summer sun, and by 26 July another heat wave was in the making. On 30 July the mercury touched 104° at St. Louis and 103° at Richmond, Virginia.

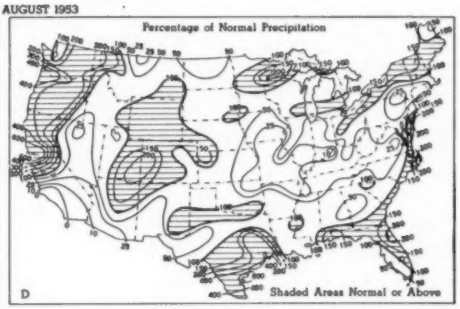
The circulation pattern of August showed a gradual reinforcement of anticyclonic conditions as the ridge in the central parts of the country strengthened. But there were notable differences from the pattern which had dominated in June. The trough off the Atlantic Coast deepened again, and at the same time the Pacific Coast trough appeared to be more fully developed. Over the continent the central ridge built up to great proportions, but appeared further north than in June and had meridional extensions northward well into the sub-Arctic. Thus, troughs and ridges had much greater amplitude than in July, and long waves appeared in the westerlies. Southwesterlies dominated the West and brought dry air there; northwesterlies prevailed much of the time in the East to bring continued continental dryness. The orientation of the ridge prevented Gulf air from moving northward.

The chief cyclonic development of the month was hurricane "Barbara." It first appeared on the weather maps on 10 August east of Florida, probably induced by an easterly wave. It found an easy track northward in the existing Atlantic trough and crossed the Cape Hatteras area on the night of 13–14 August as a small, tight-knit hurricane. Continuing northward off the Atlantic Coast, "Barbara" developed into a great extra-tropical storm and merged with an enormous low pressure center over Labrador-Quebec. From there it dominated the circulation over much of central and eastern Canada and the United States and set the stage for the development of the anticyclone which brought on the great August heat wave.

The ridge conditions over the interior of North America favored the development and movement of a polar anticyclone southwards in the wake of the disturbance that "Barbara" had created. Unusually cold polar air flowed across the border, and many new early season cold records were set in the Ohio Valley and in the Southeast as clear skies permitted rapid nighttime radiation. The high pressure cell at the surface stalled over the upper Great Lakes on 15 August and remained in that general vicinity until 25 August, showing remarkable persistency for this season of the year. Then it began to drift slowly southeastward, made a secondary stop-over in West Virginia, and finally passed off the coast and merged with the Bermuda high on 3–4 September. The transformation of the polar air mass that accompanied



Departure of mean temperature from normal in degrees F., August 1953. USWB chart.



Percentage of normal precipitation, August 1953. USWB chart.

the anticyclone is the story of the gradual change from the delightfully cool days of mid-August to the debilitating heat wave of late August.

Ninety-degree readings appeared at St. Louis on 22 August and reached New York City on 24 August, and the greatest late season heat wave in history and the most widespread since 1936 was on. Readings topped the century mark from Wiscousin and Ontario southward and eastward. On the same day, 2 September, Chicago and Boston had 100° readings. In many eastern areas the persistence of the heat was the worst aspect of the spell. In New York City the maximum topped 90° for 10 consecutive days, which exceeded the previous record by two days. At the nearby Newark Airport the mercury reached 105° to equal the all-time high for that station. Hartford's reading of 101° was the highest ever at that Connecticut city. The one saving feature of the heat spell was the relative dryness of the air since the circulation until the last two or three days was from the interior of the continent. Thus, nighttime readings were moderate and reviving sleep possible.

The climax of the heat wave came on 2–3 September when many new all-time September maxima records were set in the Middle West, Middle Atlantic States, and New England. Many stations had never experienced 100° plus readings so late in the season. Record searchers had to dig all the way back to September 1881 to find anything comparable. In all, it was the worst combined drought and heat wave since July 1936 during Dust Bowl days.

Relief made an appearance on the northern Plains on 2 September as the first substantial cold front in almost three weeks started southeastward. The cold air mass made painfully slow progress, but finally reached the Atlantic Coast on 5–6 September just as hurricane "Carol" was making a sweep toward the New England coast to upset the plans of many Labor Day weekenders.

WEATHER BUREAU CAREERS

(*Continued from page 142*)

orological Aids maintain appropriate records of weather data and assist in other duties, such as dissemination of forecasts and weather information for public use.

New appointees in the Weather Bureau are selected from registers of eligibles established by competitive Civil Service Commission examinations. Appointments are made from the top of the registers in accordance with Civil Service rules. Information regarding Civil Service examinations for meteorological positions may be obtained by writing to the U. S. Weather Bureau, Washington 25, D. C.

LABORATORY OF CLIMATOLOGY

A unique program in practical education in climatology is in progress at Seabrook Farms in southern New Jersey. The project was established in 1947 in an effort to find means of dealing on a scientific basis with the many climatic and meteorological problems associated with a large farm enterprise. In this venture the Seabrook Farms, the world's largest integrated farming-freezing operation, and the noted Johns Hopkins University of Baltimore cooperated in establishing the Johns Hopkins Laboratory of Climatology.

Dr. C. W. Thornthwaite, well-known for his progressive thought in the field of applied climatology, was the organizer and is the current director of the Laboratory. A course of study was developed, and a limited number of students at the graduate level have been accepted for training. Students from many parts of the world have since studied there. An important part of the training consists of a climatology field course in which students work on practical problems for which they receive compensation. Those interested in pursuing their graduate studies in this field should communicate with the Executive Officer, The Johns Hopkins Laboratory of Climatology, Seabrook Farms, Seabrook, New Jersey.

METEOROLOGY FOR PILOTS

A new correspondence course, recently developed for practical use by airline flight personnel, has just been made available to the public. The course consists of 15 lessons and is conducted by professional meteorologists. For full details and costs write to Compass Point Aviation, 20 Morel Circle, Greenwood, Mass.

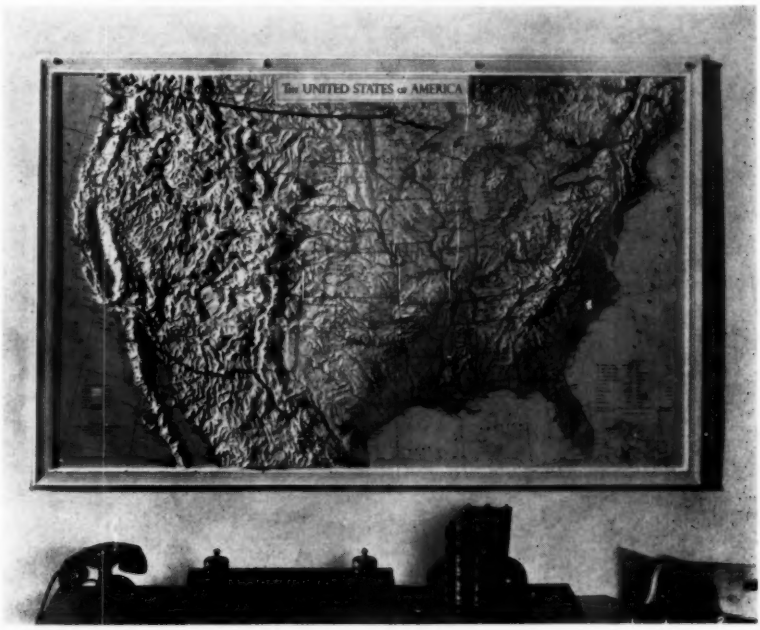
Amateur Weatherman's Almanac—1953

The Annual for all Weathermen

90 pages illustrated
all for one dollar

For your copy, send $1.00 now to:

WEATHERWISE,
Franklin Institute, Phila. 3, Pa.



AERO PLASTIC RELIEF MAP

This physiographic relief map of the United States is an excellent visual aid for the weather forecaster and student of meteorology. This is the map selected by the U. S. Weather Bureau for display in airport weather stations. It makes a handsome and valuable addition to your office or home study.

DURABLE—Molded from tough, sturdy Vinylite. Built to last . . . year after year.

LIGHTWEIGHT—Only 2¼ pounds . . . so light a child can move it.

LARGE SIZE—64 x 40 inches.

CLEANS EASILY—A damp cloth wipes off all dust, fingerprints and dirt.

SELF-FRAMED—Framed in the same sturdy vinyl plastic as the map itself. Brass grommets. Four small nails support the map . . . anywhere.

SCALE—1″ = 50 miles.

VERTICAL EXAGGERATION—20 to 1.

COLORFUL—Printed in 11 vivid colors to emphasize relief features.

DETAILED—2,000 cities, 600 rivers, 300 national parks, 200 mountain ranges and peaks, and several thousand lakes and reservoirs.

Send for this Decorative, Striking Map . . . Today! — $37.50

fob. Phila.

SCIENCE ASSOCIATES

401 North Broad Street **Philadelphia 8, Pa.**

WHEN IT COMES TO WEATHER.....

BENDIX-FRIEZ

OFFERS THE RIGHT INSTRUMENT TO DO THE BEST JOB

FOR RECORDING TEMPERATURE, HUMIDITY

Hygro-Thermograph

The leader in its field. Noted for precise accuracy and long-time dependability. Portable, easy to operate. Widely used in laboratories, factories and offices.

Portable Temperature, Humidity Recorder

Rugged, compact design. Ideally suited for use in small space and difficult locations. Provides convenient 3 x 5 charts for 10 or 30 hour records.

FOR CHECKING BAROMETRIC PRESSURE

Microbarograph

A key meteorological instrument. Records atmospheric pressure to within 0.01 inch mercury. Record chart expanded 2½ times for greater visibility.

Aneroid Barometer

Inexpensive, dependable, easy-to-read. Shows pressure and barometric tendency. Housed in handsome brass case. Favored by professionals and amateurs alike.

FOR MEASURING WIND SPEED, DIRECTION

Aerovane*

Indicates and records wind speed and direction. Recognized as "best all-purpose wind measuring instrument yet devised." Readily installed and easily maintained.

Windial*

A fine precision instrument with large dials that show wind speed and direction at a glance. Popular with smaller airports, yacht clubs, schools, plants, etc.

*REG. U. S PAT OFF.

FRIEZ INSTRUMENT DIVISION of Bendix
AVIATION CORPORATION

1412 TAYLOR AVENUE • BALTIMORE 4, MARYLAND

Export Sales: BENDIX INTERNATIONAL DIVISION, 205 East 42nd St., NEW YORK 17, N.Y.